Apparatus for video access and control over computer network, including image correction

Publication number: CN1278384
Publication date: 2000-12-27
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Classification:
- International: G09B5/10; G06F17/30; G09B5/14; H04N7/14; H04N7/15; H04N7/173; G09B5/00; G06F17/30; H04N7/14; H04N7/15; H04N7/173; (IPC1-7): H04N7/10; H04N7/14
- European: G06F17/30E; H04N7/14; H04N7/14A3; H04N7/15; H04N7/173B2; H04N7/173B4
Application number: CN19988010624 19980903
Priority number(s): US19970923091 19970904

Also published as:
WO9912349 (A1)
WO9912349 (A1)
EP1025696 (A1)
EP1025696 (A1)
MXPA00002312 (A

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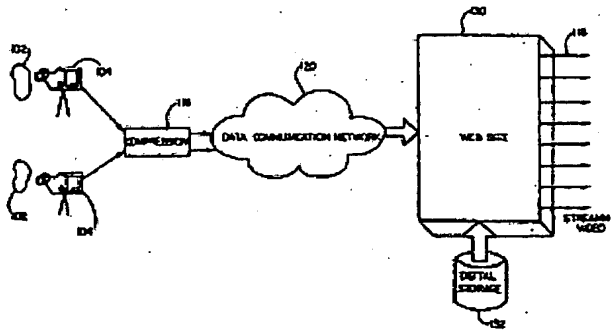
Abstract not available for CN1278384
Abstract of corresponding document: **WO9912349**

The present invention relates to a method and apparatus for communicating multiple live video feeds over the internet. Users may be able to view a plurality of remote locations (102) in real time. In another embodiment of the invention, users are able to remotely control a video picture of a distant location. The remote control may be either actual control of a remote video camera or perceived remote control by the manipulation of audiovisual data streams. In one embodiment, text, graphics, and other video information supplement one or more video pictures to provide an educational and entertaining system. In accordance with the present invention, information is accessible to users who are viewing multiple video pictures. The information relates and describes what is being viewed. Users who have different types of equipment, with different data rates, are able to access and use the system of the present invention. In another embodiment, users may interactively communicate with a video lecturer by asking questions and receiving answers. The invention may be connected to, and in communication with, broadcast and/or cable television systems.



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APPARATUS FOR VIDEO ACCESS AND CONTROL OVER COMPUTER NETWORK, INCLUDING IMAGE CORRECTION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority based on U.S. Provisional Patent Application Serial No. 60/025,604, filed September 9, 1996, entitled "Apparatus For Video Access And Control Over Computer Network", and this application claims priority based on U.S. Provisional Application Serial No. 60/033,485, filed December 20, 1996, entitled "Apparatus For Video Access And Control Over Computer Network, Including Image Correction". Both provisional applications are incorporated by reference in their entirety.

INCORPORATION BY REFERENCE

Additionally, the following patents, patent applications and publications are incorporated herein by reference:
U.S. Patent No. 5,559,549, issued September 24, 1996 to Hendricks et al.,
U.S. Patent 5,600,573, issued on February 4, 1997 to Hendricks et al.,
U.S. pending patent application Serial No. 08/352,205, filed December 2, 1994, entitled NETWORK MANAGER FOR CABLE TELEVISION SYSTEM HEADENDS, now
U.S. Patent No. 5,185,667, issued February 9, 1993 to Zimmerman,
U.S. Patent No. 5,313,306, issued May 17, 1994 to Kuban et al.,
U.S. Patent No. 5,359,363, issued October 25, 1994 to Kuban et al.,
U.S. Patent No. 5,384,588, issued January 24, 1995 to Martin et al.,
U.S. Patent No. 5,489,940, issued February 6, 1996 to Richardson et al.,
PCT Publication No. WO 96/07269, published March 7, 1996 by Jambhekar et al.,
PCT Publication No. WO 96/08105, publishedMarch 14, 1996 by Labun,
PCT Publication No. WO 96/18262, published June 13, 1996 by Richardson et al.,
PCT Publication No. WO 96/21173, published July 11, 1996 by Harris et al., and
PCT Publication No. WO 96/21205, published July 11, 1996 by Harris et al.

BACKGROUND OF THE INVENTION

This invention relates to the distribution of audiovisual signals through communications networks such as computer networks and servers. The invention has particular use with respect to global networks such as the internet and "World Wide Web". The invention also relates to education. Particularly, the invention provides an alternative to in-person classroom instruction.

1. Field Of The Invention

The present invention relates to the fields of education, audiovisual systems, communications systems and computer networks.

Individuals from around the world exchange ideas and information with each other in order to learn more about other people, cultures, and the environment in which we live. Video and audio signals are commonly transmitted over broadcast communications media to provide viewers with news and entertainment.

Computer networks are used for the remote exchange of data and other information.

Broadly speaking, these systems are attempts to communicate useful knowledge between geographically separate individuals and institutions. The invention generally relates to improvements in the transmission of information between remote locations.

2. Description Of Related Art

There is a constant desire to improve education and knowledge at all levels.

It is thought that true human progress can only be achieved if people's understanding of each other is improved and if people's understanding of nature and the environment is improved. Traditionally, education and knowledge have been obtained in schools from classroom instruction and from the reading of books.

The disadvantage of current classroom instructional systems is that students must be physically present in the classroom to participate in the educational process. Therefore, students who are geographically displaced from the location of the classroom often cannot attend class instruction as often or as timely as students who are nearby to the classroom.

The disadvantage of textbooks is that they are often not kept current with recent events or technological

changes. Textbooks are usually only updated on a yearly or less frequent basis, while important changes may occur monthly or more frequently. Also, to save funds, schools may not purchase new textbooks even though the textbooks have been updated. Therefore, the new knowledge, although available, is not communicated to students.

Recently, audiovisual presentations have begun to be used in the field of education. These systems may provide playback of a recording of a lecturer who provides a presentation on an educational topic. For example, students may learn about math from watching a videotape or television broadcast of a math professor's lecture. Education can also occur on a more informal basis. For example, specialty channels in the United States such as the Discovery Channels and The Learning Channels (headquartered in Bethesda, Maryland, U.S.A.) broadcast educational programming which both entertains and educates a diverse viewership.

The disadvantage of these audiovisual systems is that they are not interactive.

Students are unable to ask questions, and the lecturer is unable to tailor the presentation of material to the specific needs of the current student audience.

Consequently, the needs of the students are not met.

Cable and broadcast television are commonly known media which supply information to large numbers of viewers equipped with receivers known as "television sets." By receiving a broadcast, cablecast or satellite signal, users are able to view scenes from remote locations and observe newsworthy events which occur far from the user's location. However, conventional television is a one-way media in which users cannot communicate with each other or the broadcaster.

Recently, the advent of the "internet," and "World Wide Web" in conjunction with the proliferation of personal computers, has allowed people to exchange information and ideas on a global and inexpensive basis. Generally speaking, the internet is a large computer network which connects "host" computers. Users with a computer, modem and telephone line commonly call via telephone to connect with a "host." The "host," being in communication with other hosts (connected to other users) is able to transfer information between users. The internet is used, for example, to transfer data files, still images, sounds and messages between virtually any two points in the world with telephone access.

The use of the internet has increased dramatically since 1981, when approximately 300 host computers were linked together. It has been estimated that in 1989, the number of linked host computers was fewer than 90,000, but by 1993, over a million host computers were connected. Currently over 9.4 million host computers are linked (not including the personal computers people use to access these hosts via modems) and as many as 40 million people around the world may have access to the internet medium. This number is expected to grow to 200 million by the year 1999.

Users on the internet are able to transfer text, graphics, and still pictures between remote locations. Other types of information which can be transmitted include files containing prerecorded sequences of images. To view these images, users download a large data file, and after running appropriate software, see a sequence of images on the computer screen. These images are not provided in real time, and are not viewable while the user is accessing theinterest.

Therefore, even though the internet is a two-way communication medium, it is not currently being utilized to provide video information and audiovisual presentations. This is a disadvantage, in that a large number of people have been accustomed to television audiovisual presentations, and prefer an audio-video presentation to a textual or graphical presentation.

What is needed is a medium of communication that is interactive and which carries audio, video, text, and graphics.

What is needed is an educational system which is user friendly and entertaining.

What is needed is to improve the internet such that users can access many audiovisual programs.

What is needed is to provide users with live video from remote sites.

What is needed is a remote video system with increased realism and accuracy, such that users feel as though they were actually present at the remote location.

SUMMARY OF THE INVENTION

In accordance with the present invention, video is collected at a remote site. (The term "video", as used herein, includes stereophonic or monophonic audio signals which may accompany a video signal. Additionally, "video" is used broadly herein to include still images, groups of related still images, animation, graphics, pictures, or other visual data.) The remote video information may be obtained from a video cassette, CD ROMs, television channels, one or more video cameras, or other well known sources. If video cameras are used, they may be connected to a computer so that they are remotely controllable, or they may be oriented such that a perception of control can be created for users. The video may relate to remote sites of interest, such as a pyramid in Egypt, or the images may relate to an educational lecture being conducted at a remote site.

The collected video is transferred to a web site, either in compressed or uncompressed form. The video may be physically transported or may be transmitted through a communications medium to the web site.

The web site contains a storage media which may store some or all of the video. Additionally, the web site passes camera control commands, if applicable, to the remotely controlled cameras or may simulate the remote control of a camera.

The main function of the web site is to pass video to a plurality of users, through a communication media such as the internet, in response to user selections. The video passed to the plurality of users may be live video being fed to the web site, or may be stored video. A number of video servers are used to output the video to the users through the communications media, such as the internet. The video may be tailored by the web site for the particular user's hardware, including data communication equipment, or memory size, etc.., i.e. the data rate matches the highest speed which the user's equipment can handle.

Users receive and display the video sent from the web site. Many simultaneous video pictures may be received. Of course, the quality and frame rate of the video is dependent on the user's communications hardware. Users with highspeed modems or cable modems receive higher quality video. The users are able to send commands and/or queries to the web site. The commands and queries are forwarded to remote locations to control remote cameras or query remotely located instructors. Alternatively, the commands cause the web site to change from among many video signals with different camera angles or locations (or to transmit a different portion of a wide angle image), causing the user to have a perception of remote camera control. The user's commands may also cause a different portion of a received wide angle image to be displayed, giving the user a perception of camera control.

In addition to video, the web site provides information, such as graphics and text, which is related to the video. This information may be automatically supplied, or provided upon user request. Therefore, the user is provided with a comprehensive set of information concerning remote sites, enabling the user to be quickly educated about the remote site of interest.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of an embodiment of the invention where remote video is provided to a web server by videocassette and by ordinary television.

Figure 2 is a block diagram of an embodiment of the invention where remote video is provided by remotely located cameras and a communication network carries the video to the web server.

Figures 3A and 3B are a block diagrams of an embodiment of the invention using the embodiments of Figures 1 and 2 with remotely controllable cameras.

Figure 4 shows remote cameras positioned around a building for perceived camera control.

Figures 5A, 5B, 5C, and5D show video images from specific cameras shown in Figure 4.

Figure 6 shows remote cameras deployed to follow a parade route.

Figures 7A and 7B show remotely controlled cameras at a remote location.

Figures 8A and 8B show a single remote camera at a remote location, where the camera has a 180 degree spherical (or other wide angle) lens.

Figures 9A and 9B are block diagrams of a server platform.

Figure 10 is a block diagram of communications paths from the server site to remote users.

Figure 11 shows a home page in accordance with an embodiment of the invention.

Figure 12 shows a "society" page in accordance with another embodiment of the invention.

Figure 13 shows a "map" page of remote camera locations throughout the world.

Figure 14 shows a "watch" page containing live video feeds from five remote cameras.

Figure 15 shows a page directed to determining the user's data rate.

Figure 16 shows a page of an interactive lecture.

Figures 17 and 18 show pages of an embodiment of the invention which combines live video, prestored video, graphics, and interactive questions.

Figure 19 shows a flow diagram of a method of automatically monitoring and panning an area using perceived camera control.

Figure 20 is an exemplary screen display of the present invention, showing video and also showing video data.

Figure 21 is a diagram showing the interaction between a computer network embodiment of the present invention and a cable television system.

DETAILED DESCRIPTION OF THE DRAWINGS

As stated previously, the present invention is related to obtaining video from remote sites and interactively presenting that video to users. The video is obtained at a remote site, communicated to a web site (where it may be stored), and forwarded to users.

1. Obtaining Video From Remote Sites, Communicating the Video to a Web Site, and Streaming the Video To Users

Figure 1 shows a preferred embodiment of the invention where remote video sources are videocassette and television programs. Figure 1 shows remote sites 102, remote cameras 104, videocassette 106, compression devices 108, 114, digital storage device 110 and web site 112. As shown in Figure 1, a video camera 104 is used to film activity at remote site 102. As discussed below, numerous video cameras at a single remote site may be used to obtain different views and audio (preferably stereophonic) of the remote site from different angles and orientations. Also, numerous remote sites, each with its own video camera, may used as shown at 102', 102" and 104' and 104". The video cameras film events at the remote sites, and record the events on videocassette 106 or other suitable media.

The recorded information is then transported to a web site 112, or to a site in communication with web site 112. As shown in Figure 1, the recorded information from video tape 106 is then compressed in compression unit 108 and stored in digital storage media 110. Many compression algorithms may be used, such as MPEG-1, MPEG-2 and Wavelet. Compression systems currently available from The Duck Corp., Xing Technology Corp., Indeo Digital Video Arts, Ltd., VDOnet Corp. and Intel Corp., may be used with the system. The digital storage media may be any known storage device, such as a hard disk, CD ROM, digital video disc (DVD), digital tape, video file server or other media.

The stored and compressed audio/video is then provided on a number of streamed audio-video outputs 116 from the web site 112. This enables many users to access the stored video and audio, and allows for one user to receive numerous audio-video signals, i.e. split the display into numerous "camera" feeds.

In addition to providing streamed audio and video from videocassette, the web site 112 may provide audio and video from television channels. The television signals are received by a conventional television receiver (not shown), and digitally compressed by the compression unit 114 and fed through the web site 112 to the streamed output. It is not normally necessary to store the television programs in a digital storage unit (such as the storage unit 110), since the audio and video is constantly incoming and changing. However, certain segments of broadcast television may be stored in a storage device (not shown) for recall by a user.

Figure 2 shows another embodiment of the invention where similar reference numerals indicate items that correspond to the items shown in Figure 1. The system of Figure 2 uses remote cameras and a communication network to provide remote video to the web site. Figure 2 shows remote sites 102, video cameras 104, compression unit 118, data communication network 120, web site 130, digital storage unit 132, and streamed video 116.

As shown in Figure 2, remote sites 102 are filmed by cameras 104 (as in Figure 1). However, in this embodiment, the output of the cameras 104 pass through a compression unit 118. The compressed audio and video is communicated over data communication network 120 to web site 130. The data communication network 120 may be any network currently known to one of ordinary skill in the art, such as land-leased lines, satellite, fiber optic cable, microwave link or any other suitable network.

Other suitable networks may be cellular networks or paging networks. In a paging network, cameras 104 may be connected to a paging device and/or digital storage media or paging transmitter for communication of the video (including still images) to the web site 130. The following publications, hereby incorporated by reference, disclose relevant systems: PCT Publication No. WO 96/07269, published March 7, 1996 by Jambhekar et al.; PCT Publication No. WO 96/21173, published July 11, 1996 by Harris et al.; PCT Publication No. WO 96/21205, published July 11, 1996 by Harris et al..

The web site 130 in this example is adapted to receive information from the data communication network 120. The web site may pass the video from cameras 104 to users at streamed video outputs 116. In alternative embodiments, the web site may contain a decompressor to decompress the video prior to streaming it to users, or change the compression scheme of the video to one which is compatible with the connected user. Alternatively, the video may be compressed at the streamed video output and users who connect to the web site 130 may run decompression software.

The web site 130 may store the audio and video received over data communication network 120 in digital storage unit 132 before providing it to the streamed outputs 116. Alternatively, the audio and video may be directly passed to the streamed outputs 116.

Figure 3A shows another embodiment of the invention that combines the embodiments of Figures 1 and 2 and adds remote camera control. Figure 3A shows remote sites 102, cameras 104, computer 134, video path 122, 129, control path 124, 126, 128, compressors 108, 114, 118, 136, data communication network 120, web site 140, digital storage means 132, and streamed video 116. As with Figures 1 and 2, remote sites 102 are filmed by camera 104. As with Figure 1, the web site 140 is able to receive video tape 106, compress the audio and video in compression unit 108, and store the compressed audio and video 110. Audio and video from television stations may also be compressed by compression unit 114 and stored or passed as streamed video 116, as in Figure 1.

Likewise, the cameras 104 may be connected to compression unit 118 (as in Figure 2) and communicate compressed audio and video to web site 140 via data communication network 120. Thus the functions performed by the embodiments shown in Figures 1 and 2 may be combined in a variety of manners at a single web site 140.

Figures 3A and 3B add the additional feature of camera control to the previously described embodiments. As shown in Figure 3A, a computer 134 is connected to remote camera 104. The computer is able to control a mechanical or electrical device on the camera 104, to alter the camera's orientation (including position and/or angle). Audio and video from the camera 104 passes to the computer 134. The video may be processed and stored in the computer. Preferably, as shown in Figure 3B, the computer is connected to multiple remote cameras 104' and 104" so that multiple users may each control a camera. The computer 134 may either contain a compressor or be connected to an external compression unit 136.

The video from cameras 104' and 104" is compressed and provided to data communications network 120. This compressed video is subsequently received by web site 140. The remote cameras 104', 104" (Figure 3B) may be controlled by control signals passed from computer 134 on path 124. The control signals are received by computer 134 from the data communications network 120 over the camera control path 126. The web site 140 provides the control information to the data communications network 120 over path 128. The web site 140 of this example is adapted to pass control signals to cameras 104 and to store video images in a digital storage means 132. The web site provides a number of streamed video outputs 116 as in the other examples.

This embodiment allows remote users to control the angle or orientation of cameras 104', 104". Users are connected to the web site 140 and receive the streamed video 116 from the cameras 104', 104". If the users wish to move the camera 104', 104" to the right, they may enter a user command (such as "pan right") at their terminal. The command is received by the web site 140, and formatted, if necessary.

The command is outputted to the data communication network 120 as a control signal through the camera control path 128. The remote computer 134 receives the camera control signals from the communication network 120 over camera control path 126. The remote computer 134 may be adapted to control multiple

cameras at multiple locations 102, or multiple cameras at the same location 102.

The computer 134 is connected to the remote camera 104 by a camera control path 124. This path allows control commands from the computer to travel to the cameras 104', 104" and control the cameras 104', 104". The cameras 104', 104" may have computer-controlled swivel motors (not shown) for panning left and right, may have a computer-controlled pivot motor (not shown) for panning up and down, and may have a computer-controlled motor (not shown) for moving a zoom lens. These motors are known to the artisan and are currently available. A plurality of cameras may be provided at a single site to allow multiple users to have camera control at the same time.

This system of obtaining and/or storing video at a web site is extremely flexible. The system allows for perceived camera control by multiple cameras, actual camera control of one or more cameras, perceived camera control via a wide-angle lens on a single camera, and for the generation of comprehensive interactive programs.

2. Perceived Camera Control With Multiple Cameras

In one alternative embodiment, shown more clearly in Figures 4-6, users are given the perception of camera control. To achieve this, a plurality of fixed cameras 104, 150, 152, 153, 154, 156, 158, 160, 162 (Figure 4) are disposed around a remote site 102. In accordance with this embodiment, it appears to users that they are controlling the angle or position of a camera when in actuality they are merely being transferred to the video output of a different camera. Figures 4-6 show this concept in greater detail.

As shown in Figure 4, a building 146 is being prepared for demolition.

Disposed around the building 146 are cameras 104, 150, 152, 153, 154, 156, 158, 160, 162, connected to a computer 135. The computer 135 is connected to a communication network 120 (not shown). The video from cameras 104, 150, 152, 153, 154, 156, 158, 160, 162 is digitized and preferably compressed prior to communication over network 120, either by compressors connected to the cameras (not shown) or by a compressor connected to the computer 135 (not shown). The cameras may be digital cameras or analog cameras connected to an analog-to-digital converter.

The cameras specifically identified around the periphery are cameras 150, 152, 153, 154, 156, 158, 160, and 162. For reference, the building contains the letter "A" and the letter "B" on two sides as shown at 144 and 148 in Figures 4 and 5. A number of additional cameras 104 are disposed about the periphery of the building in a circular pattern. The pattern and number of cameras are not critical, but will control how the user perceives movement of the "camera".

Referring to Figure 4, a video camera 150 faces side A, a video camera 152 is between sides A and B, a video camera 153 faces side B and a video camera 154 is between side B and the side opposite side A. The video cameras 156, 158, 160 and 162 are disposed closer to the building, as shown. All the video cameras contain audio pickups (preferably stereo). Additionally, all the video cameras are connected to a computer 135 which outputs compressed audiovisual signals to the communication network 120 and consequently to the web site. The system shown in Figure 4 may be implemented by the systems shown in either Figure 2 or Figure 3.

Any number of users in communication with the web site 130, 140 may receive the audio and video from these cameras.

Figure5A shows a typical screen view 150 of the video presented to remote users who are connected to the web site of the present invention. As shown, the user is observing live video from camera 150, which provides a view of the building on side A. A "toolbar" of commands 151 is presented to the user, including a pan left command "c", a pan right command "z", a pan up command "o" and a pan down command "a". An "autopan" command is used in conjunction with another command (such as pan right). The "autopan" command is used to automatically move the picture position in the direction previously entered. For example, if "autopan" is entered after "pan right," then the picture will keep panning right until another key is pressed or a default key (such as the ESCape key) is pressed. The speed of the "autopan" function is controlled by the "speed" command, which is used in conjunction with the "+" and "-" commands. Additionally, the "+" and "-" commands, when used alone, control a "zoom-in" and "zoom-out" function, respectively. The "toolbar" commands are selected via a user input device, which may be a keyboard, mouse, trackball, remote control, etc.

When any user wishes to switch from the view of the camera 150 (Figure5A) and pan to the right, the user initiates a pan right command "o", which is transmitted to the web site 130, 140 (Figures 2 and 3). The web site receives the command, and in response, causes the video from the camera positioned to the right of the

camera 150, in this case the video camera 152 (Figure 4) to be transmitted to the user. The user then observes the picture appearing in Figure 5B, which appears to be a view to the right from the previous position (camera 150). If the user continues to pan right, he is presented with the Figure5C view, received from the camera 153. The user may continue to pan right all away around the building in this manner.

Additionally the user has special functions available, such as "autopan" and "zoom." For example, "autopan" in conjunction with "pan right" would cause the view of the building to rotate, at a speed dictated by the "speed" function and the "+" and "-" keys. Using the "+" and "-" keys alone causes the view to change to a closer camera ("+") or a camera further away ("-"). As shown in Figure 4, the cameras 156, 158, 160 and 162 are disposed closer to the building than cameras 150, 152, 153 and 154. A "magnified" image, obtained from the camera 156, is shown in
Figure 5D. If no cameras are disposed closer or further away, digital image processing may be used to digitally increase or reduce the size of the image. The software which controls these functions may be disposed either at the web server or on the user's computer.

Thus, users may obtain different views of the building 146 as if they were remotely controlling the positioning of a single remote camera. The users may observe the demolition of the building from many exciting perspectives. This "perceived" camera control is advantageous because it allows any number of users to "control" a camera. A single camera which is remotely controllable is only controllable by a single user. Thus, the present invention is suitable for large audiences. The realism of this perceived control is directly dependent upon the number of cameras and their distances from the viewed object.

Therefore, when the building 146 is demolished, any number of users may pan around the building in real time as if they were actually present at the site.

When the building is demolished, the video cameras pick up, preferably in stereo, the sounds of the demolition. Users who have loudspeakers connected to their computer may experience the demolition almost as if they were present.

Figure 6 shows a deployment of a number of cameras 104 which are arranged in a linear fashion around a point of interest, each camera conn parade they are interested in, for as long as they desire, without worry that they have missed an interesting band or float. In this example, the camera deployment merely follows the parade route. Parents who have children in a band or float may search for the child and follow the child throughout the parade route, rather than having to monitor every moment of the parade on television in the hopes that the child will pass the reviewing camera when the parents are watching. The parents merely "move" from different cameras along the parade route as their children progress in the parade.

3. Actual Camera Control of Single/Multiple Cameras

Figures 7A and 7B show another embodiment, where a number of cameras 160, 162, 164, 166, are provided. These cameras are in direct communication with and are controlled by computer 170. Although it is possible to form a ring of cameras to perform "perceived" camera control (as in Figures 4-6), the embodiment shown uses four cameras 160, 162, 164, 166 which contain motors 105 (Figure 7B) for controlling the camera's positioning. The motors are controlled by computer 170.

Either a single computer 170 or a number of computers 170 may be used. The remote location and point of interest shown in Figures 7A and 7B are, for example, a watering hole or desert oasis. Users who access the web site 140 are able to observe live video of wildlife behavior at the watering hole. The cameras 160, 162, 164, 166 are disposed at an island in the middle of the watering hole. The toolbar 151 of Figure 5 is also used in this embodiment and enables users to choose camera control commands to spin the cameras around or perform other camera functions, such as zoom. Users are therefore able to receive different views and angles, and observe the entire watering hole.

Figure 7B shows the control and video paths of the Figure 7A system combined with system shown in Figures 3A and 3B. The video from cameras 160, 162, 164, 166 is communicated to computer 170, in compressed or uncompressed form on path 122. The computer 170 communicates the video to communications network 120 for reception by the web site 140 (Figures 3A, 3B). Preferably the video is digitized and compressed by either the cameras 160, 162, 164, 166, the computer 170, or an external analog-to-digital converter (not shown) and compressor 136 (Figures 3A, 3B) prior to transfer to the communications network 120.

Camera control commands are received by the computer 170 on control line 126, as shown in Figures 3A, 3B and 7B. The commands are formatted, if necessary, by computer 170 and transferred to control units 105 attached to cameras 160, 162, 164, 166. The control units 105 are connected to spin, zoom, or otherwise control the cameras as directed by the user.

Communications links 124 and 122 may be wired, wireless, digital or analog, and computer 170 may be located nearby or remote from the site 102.

The system of Figures 7A and 7B are unlike the embodiments shown in Figures 4-6, because each user is assigned a remote camera in the Figure 7A, 7B embodiment. Since each user must be assigned their own controllable camera, users will have to contend for available cameras. The number of controllable cameras may range from a single camera to any number, and is preferably statistically determined to correlate to the average number of users who access the web server 140 at any given time or at peak times. The number of cameras may be reduced by using known systems which utilize queuing, reservations, and time limits.

4. Perceived Camera Control Using A Single Camera And A Wide-Angle Lens.

Figures 8A and 8B show another embodiment, using only a single camera, where an unlimited number of users may view any portion of the remote site 102.

This embodiment uses a spherical lens 182 in optical communication with the camera 180. The remote site 102 shown in Figure 8 is a remote watering hole or oasis as in Figures 7A and 7B.

As shown in Figure 8A, a camera 180 has a spherical (or other wide angle) lens 182, which provides a1800 spherical (or other wide-angle) view. This view, which is communicated to a computer 184, contains distortion. The computer 184 communicates and compresses the distorted video back to the web site 130 or 140 which stores and may process the image. Rather than using the computer 184, a simple transmitter may be used to convey the entire spherical video to the web site 130, 140 (Figures 2 and 3). By using appropriate image processing software, the web site removes the barrel distortion and stores data relating to the entire spherical view. Users may then access different portions of the1800 sphere. In this embodiment, the toolbar 151 of Figure 5 is also used. By using the toolbar 151, users may move across the spherical view and obtain the "perception" of camera control.

This embodiment is advantageous in that it can provide the perception of camera control to any number of users simultaneously using only one remote camera.

Figure 8B shows alternative embodiments of the system shown in Figure 8A.

As shown in Figure 8B, the spherical (or other wide angle) lens 182 is used with video camera 180", which conveys video information to computer 184. Computer 184 communicates the video over communications network 120 to the web site 130.

The web site 130 may store or process the received video, and make the video available to users at user terminals 302, 304, 306, 308, 310 by communicating the video over communication network 125. Communication network 125 is explained in more depth below with respect to Figure 10.

Because wide angle lenses generate distortion, processing is conducted on the distorted image to remove the distortion from a segment of the image. This processing may be performed at the computer 184, or the web site 130, but is preferably performed at the user terminals 302, 304, 306, 308, 310.

Thus, the web site 130 has available wide angle video for sending to users.

Users display and view only a segment of the wide angle video at a time. Then, by using toolbar 151 (Figure 5), the user may select adjacent segments of the video for view. When a user selects an adjacent segment of the video for display, the adjacent segment is processed to remove distortion and then displayed. Displaying the adjacent segment gives the appearance that the camera was physically "moved" to the adjacent side of the original segment.

One system for electronically removing the distortion from a segment of an image obtained from a fish-eye lens is disclosed in U.S. Patent No. 5,185,667, issued February 9, 1993 to Zimmerman, incorporated herein by reference. Zimmerman's apparatus uses the following hardware for processing a captured and digitized image: a microcomputer connected to a remote control, computer control, X-Map and Y-Map, an input image buffer connected to the X-Map and Y-Map with an output connected to an image filter and an output image buffer. This hardware, for example, or any other suitable hardware, may be placed at the computer 184, or the web site 130, but is preferably located at the user terminals 302, 304, 306, 308, 310.

As a preferred alternative, the specialized hardware is removed and the hardware functionality is implemented in software at the computer 184 or web site 130, but preferably the software is loaded into the user terminal 302, 304, 306, 308, 310. Thus, in accordance with the present invention a spherical (or other wideangle) image is supplied to the user's terminal, which executes appropriate software (which may be a "plug-in" for a browser application program) for displaying a segment of the image (or video) without distortion. Additionally, the distorted spherical image (or video) may be saved to a storage medium, either at the user's terminal or at the web site, for future loading and viewing.

Figure 8B also shows how to remove the lens distortion without special processing. As shown in Figure 8B, a spherical (or other wide angle) lens 182 is in optical communication with a video camera 180'. However, a nonlinear imaging sensor 186 is placed between the spherical lens 182 and the video camera 180'. The imaging sensor is designed to provide a distorted output which cancels out the distortion of the spherical lens 182, and thus an undistorted wide-angle image is provided to video camera 180'. Alternatively, imaging sensor 186 may itself provide a digital output, making it unnecessary to use a camera 180'. In this case, the imaging sensor 186 would be directly connected to computer 184.

Examples of imaging sensors 186 are disclosed in U.S. Patent No. 5,489,940, issued on February 6, 1996 to Richardson et al., and in PCT publication WO 96/12862, published June 13, 1996 to Richardson et al., each incorporated herein by reference. Other suitable imaging sensors may be used with the present invention.

The image obtained by the imaging sensor 186 may be undistorted and not require further processing. A segment of the image may then be selected for display by simply passing the image data to a display device. If the imaging sensor is imperfect, further processing may occur to correct for defects in the sensor.

Additionally, further processing for "zoom" and "unzoom" functions may occur.

This further processing may take place at the web site 130 or at the user's terminal 302, 304, 306, 308, 310.

The embodiments of Figures 5 through 8 may be used in conjunction with either live audio and video or prerecorded video data (with audio) (shown in Figures 1-3). For example, if nothing interesting is happening at the watering hole, a connected user may access a stored audio and video clip of a lion attack which occurred the day before. If "perceived" camera control is utilized, the stored audio and video preferably includes all camera angles (or a wide-angle view), such that the ability to pan and zoom is preserved.

5. Web Site Configuration

Figures 9A and 9B show a more detailed view of the web site, listed as web site 140 (Figure 3), but which may also correspond to web sites 112 (Figure 1) and 130 (Figure 2). The web site 140 is connected to a data communication network 120, the internet 242, and direct connections 244. The web site contains transmission equipment 210, receive equipment 220, 220', two compression units 108, 114, a web server 200, a router 230, and communication equipment 240. The web server 200 itself contains a digital matrix switch 250, a plurality of digital video servers 252, 252', 252", 252"', a firewall access control unit 254, a database server 256, an audio and video storage unit 258, a data storage unit 260, an administrative unit 262, a digital matrix switch 264, a camera control unit 268 and a digital video matrix switch 270.

The web site 140 is connected to the data communication network 120 by transmission equipment 210 and receive equipment 220. As shown, multiple receivers 220, 220' may be used. Also, as shown, the receivers may have more than one video output. Audio and video signals may also be input to the web server 200 by videocassette (or other suitable recorded media) or simply by feeding in television programming. As with Figures 1 and 3, these signals are preferably compressed by compression units 108, 114. On the opposite side, the web server 200 is connected to remote users by a router 230 and communication equipment 240, which in turn are connected to the internet 242 or directly connected 244 to users.

The communications equipment 240 outputs the video streams 116 through a number of input/output ports.

As previously stated, the web server 200 contains a digital matrix switch 250, a plurality of digital video servers 252, 252', 252", 252"', a firewall access control unit 254, a database server 256, an audio and video storage unit 258, a data storage unit 260, an administrative unit 262, a digital matrix switch 264, a camera control unit 268 and a video matrix switch 270.

The digital matrix switch 250 receives all incoming compressed video signals from the receivers 220, 220' and the compressor units 108, 114. The matrix switch 250 also receives compressed video data from database server 256. Under control of the administrative unit 262, the digital matrix switch 250 outputs the input compressed video signals to digital video servers 252, 252', 252", 252"'. In this manner, any input

signal can be transferred to any video server as directed by the admin unit. Also, stored programming from the database server 256 is routed to the digital matrix switch 250 to be switched as if it were incoming live video. The outputs of the digital matrix switch 250 also connect to the database server 256, so that anything at the inputs, such as incoming live audio and video, can be stored in the database server 256.

The compressed input video is passed into various digital video servers 252, 252', 252", 252"' for formatting. Users who connect to web server 200 preferably run their own decompression software so that the no decompression need occur at the web server 200. As an alternative, the digital video servers may decompress the input video.

The audio and video from the video servers 252 are passed through a second digital (video) matrix switch 270. Since switching has already occurred at the digital matrix switch 250, the second video matrix switch 270 is not required, but is desired for maximum flexibility. It is also optimal where the number of users exceeds the number of video inputs, as one input may be channeled to numerous connected users.

In a preferred embodiment, the matrix switch 270 may contain a processor which joins different frames of video and audio such that each output contains frames for multiple video pictures (including audio). This enables users to receive split screen images of video and select an audio track for playback (see Figure 14, discussed below). The split-screen images may be formed by using known methods, which may differ depending on the type of compression used. For example, digital images may be decompressed, combined with other decompressed images, and then re-compressed, or the images may be decompressed and converted to analog, combined, and then converted to digital and compressed for transmission.

The signals switched by the video matrix switch 270 are preferably digital.

This is because the communicated video streams 116 are preferably digital. It is preferred to process all the signals in the web server in the digital domain to improve simplicity and maintain maximum flexibility.

The various streams of video output from the video matrix switch 270 are passed to the firewall access control unit 254 for output to the router 230 and the communication equipment 240.

Using this system, any user may receive any signal present at any input, including stored signals within audio and video database 258 or data storage unit 260. Additionally, any compressed digital signal present at the input to digital matrix switch 250 may be stored in the audio and video storage unit 258 or data storage unit 260. This is advantageous in the perceived camera control embodiment (Figures 4-8) where the web server 200 must output a different video picture to the user upon user request. When the user request is received by the web server 200, the administrative unit 262 directs the matrix switches 250 and 270 to output the correct video stream to the user. If the user is requesting stored video, the administrative unit directs the database server 256 to provide the video to digital matrix switch 250.

If graphics or textual data are required, the administrative unit 262 directs the database server 256 to output the text or graphics to digital matrix switch 264.

Although shown as one functional box, the database server 256 may be implemented by using several servers and/or multiport servers. The audio and video storage unit 258 and data storage unit 260 may be implemented by using many storage media of different types, such as optical storage devices (i.e. CD ROM), magnetic disks, magnetic tape, or memory circuits (i.e. RAM/ROM). The number of units depends on the amount of stored data, the number of users, and the desired output speed. The database server 256 may be one or multiple units. The audio and video storage unit 258 stores (preferably compressed) audio and video presentations, including all relevant camera angles. The video servers 252 may also be implemented as one or more servers and/or multiport servers.

The data storage unit 260 is used to store information relating to audiovisual displays. This information relates to the menu structure and screen displays communicated to connected users. The stored information may also relate to specifically to the audio and video which is currently being displayed and heard.

For example, in the demolition embodiment of Figure 5, a user may click on a "more info" icon, to obtain information on demolition. Such information, which could include statistics on dynamite, for example, would be stored as text or graphics in data storage unit 260. The "more info" command would be transmitted to the communications equipment 240, pass through the router 230, and the firewall access control 254 to administrative unit 262. The administrative unit 262 then directs the database server 256 to recall the relevant information, such as statistics on dynamite, from data storage device 260 and pass the information to digital matrix switch 264.

The recalled information is then passed to the firewall access control unit 254, the router 230, and the

communication equipment 240 for transmission to the proper subscriber. The data may be combined with audio and video in the firewall access control unit 254, or be a separate transmission.

In the perceived camera control embodiment, the communication equipment 240 forwards the user's command (such as "pan right") to the router 230, which detects the command and forwards it to the firewall access control unit 254, which passes it to the administrative unit 262. The administrative unit 262 controls the video being fed to each connected user. The administrative unit 262 also responds to user commands by instructing either the matrix switch 250 or the matrix switch 270 to pass a different audiovisual signal from another source (i.e. camera, for example, the camera to the right of the present camera) to the connected user. If the user is receiving a stored image from database 258, the administrative unit instructs the database server 256 to recall the appropriate video signal.

In the actual camera control embodiment (shown in Figures 3 and 7), commands from the user (such as "pan right") are received by the communication equipment 240 and forwarded to the router 230. The commands enter the web server 200 via the firewall access control unit 254 and are passed to the administrative unit 262. The commands may be stored in the administrative unit 262 or passed to the database server 256. Either way, the commands pass through the camera control unit 268 which formats the commands as necessary for remote camera control. The formatted commands are passed to the transmission unit 210.

The transmission unit 210 provides the commands to data communication network 120 for reception at remote cameras and CPU 134 (Figure 3).

In the spherical (or other wide angle) lens embodiment (shown in Figures 8A and 8B), where the remote camera uses a spherical lens 182, the administrative unit 262 determines which segment or quadrant of the audiovisual image is to be supplied to the user in response to the user's command. In this embodiment, the spherical image is stored in database 258 prior to being output to digital matrix switch 250. The image is split into a number of sections, which when combined form the entire 1800 sphere. By using suitable image processing software, the distortion is removed or minimized in each segment. The administrative unit 262, in response to a user command, determines which segment of the sphere should be sent to the user.

The administrative unit then directs the database server 256 to retrieve and output the correct segment to the digital matrix switch 250. By controlling the digital matrix switch 250 and video matrix switch 270, the administrative unit 262 is able to ensure that the user receives the correct segment of the spherical image.

However, as previously stated, in one preferred embodiment the entire spherical (or other wide angle) video is communicated to the user, and the distortion removed by software at the user's terminal. This minimizes the complexity of the processing necessary at the web site 140, and allows the user to store the entire spherical (or other wide angle) video.

Preferably, the communication equipment 240 is designed to automatically determine the maximum data rate at which information can be transmitted to the connected users. The data rate depends on the type of connection the web sites has with the user, and the type of equipment the user is operating. In one embodiment, the communications equipment uses the maximum data rate possible as sensed from the user's communications. Alternatively, users may enter their data rates when prompted by a menu screen, as shown in Figure 15 and described below. The data rates are then stored in communications equipment 240. The communications equipment 240 may also compress the video streams prior to transmission using any known compression algorithm. Additionally, the communications equipment may remove video frames, preferably prior to compression, such that the resulting data rate is reduced to be compatible with the user.

Figure 9B is identical to Figure 9A, but contains an input interface 225 and an output interface 235. The input interface 225 is used to obtain digital video from other sources, such as a paging system, cellular system, cable television system, etc.

The output interface connects the web site to other communications systems such as paging systems, cellular systems, or cable television systems. In the case where the input interface connects to an analog system, it contains suitable analog to digital converters (not shown). Also, where the output interface connects to an analog system, it contains suitable digital to analog converters (not shown).

For example, the input interface 225 may obtain images or video from a paging system, and the output interface 225 may be connected to a paging system to broadcast video or images to a selective call receiver. In this regard, the following publications are incorporated by reference, each of which relates video/images to selective call receivers: PCT Publication No. WO 96/07269, published March 7, 1996 by Jambhekar et al., PCT Publication No. WO 96/21173, published July 11, 1996 by Harris et al., and PCT Publication No. WO 96/21205, published July 11, 1996 by

Harris et al..

6. Communication to the User Terminals.

Figure 10 shows how the users are connected to the web site, and shows an example of a communications network 125 (Figure 8B) in detail. The connections shown in Figure 10 apply to the web sites of the previous figures, including the web site 112 (Figure 1), 130 (Figure 2) and 140 (Figures 3 and 9). Figure 10 shows a server platform 200, the internet 242, two direct connection 244, two traditional internet hosts 272, 274, two cable internet hosts 276, 278, a satellite-based internet host 280, a telephone dialup 282, an ISDN channel 284, a cable plant 286, 288, a satellite system 290 and a plurality of connected user terminals 302, 304, 306, 308, 310.

In operation, the web site 112, 130, 140 may communicate over the internet 242 to a number of different systems. These systems include a traditional internet host272,274 and a cable headend internet host 276. The traditional internet host 272, 274 may be connected via a telephone line 282 or an ISDN channel 284 to a plurality of remote user terminals 302, 304, respectively. The cable internet host 276 may be connected via a cable plant 286 to a remote user 306.

Alternatively, the web site is connected via a direct connection 244 to a cable headend internet host 278 or satellite-based internet host 280. The cable headend internet host 278 communicates to a cable plant 288 and a remote user terminal 308.

The satellite-based internet host 280 communicates via a satellite 290 to a user terminal 310. These direct connections 244 enable a higher data rate and use a high speed cable modem.

It is advantageous that the communications equipment 240 (Figure 9) enables communications with any type of user terminal no matter what the data rate or system. Of course, user terminals with higher data rates will receive higher quality audio and video images.

7. Exemplary ScreenDisplavs and Features.

Figures 11-16 show examples of display pages which are shown at the remote user's terminal. The pages and menus are stores in data storage unit 260 (Figure 9) as graphical and/or textual information.

Figure 11 shows an example of a home page, using advantages of the present invention. The home page 400 contains a number of advertisements 402, numerous web links 404, a society link 406, options for viewing television programming 408, a plurality of rapid access entry options 409 including a "World Watch Live" option 410, and options for clubs 412.

The advertisements 402 are useful for the page provider to generate revenue.

As described previously, the system is designed such that television programming can be supplied over theinterest. Users may view television programming by selecting the home page television option 408. The Magazines 404 are used to provide information concerning specific topics to the user. Users may join a society, having additional membership benefits, through the "society" selection 406. The "World Watch Live" feature 410, part of the rapid access entry options 409, is selected when users wish to watch live video from remote sites. The clubs shown in the club option 412 are selected by users who wish to obtain information related to common areas of interest.

Figure 12 shows a society menu 406, selected from the Figure 11 home menu page. As shown in Figure 12 there are options for "World Watch Live" 420, there is
an advertisement 402, subscription information 424, and numerous club options 422.

This screen and all the functions selected in response to the displayed options may be provided on a subscription or temporarily free basis.

Figure 13 shows one example of a "World Watch Live" menu 440. This menu is used to select remote locations from which to observe live or prerecorded video.

In this example, a map of the world is presented with sites that are available to select for observing live video. The screen indicates sites that are active 442 or under construction 444. This menu also contains two advertisements 402.

The "World Watch Live" embodiment allows connected users to visit virtually anyplace in the world to learn more about its culture, geography, or environment.

Coupled with perceived or actual camera control and associated prestored video, textual and graphical information, a powerful and inexpensive learning tool is realized. This is more closely shown in Figure 14.

Figure 14 shows a menu 450 which corresponds to the Egyptian site in Figure 13. This screen concerns "Giza, Egypt", and contains live video from five cameras.

As shown in the screen, there is camera one 452, cameras two through five 454, a "Map" option 456, an "About This Site" option 458, an "About Egypt" option 460, an "Upcoming Events" option 462 and a "Remote Control" option 464. Camera one 452 is the default for the main viewing camera. The user may select video image sizes and the number of images to be displayed, limited by the equipment the user is operating. Video from cameras two through five are supplied along with that from camera one to provide alternative sites and viewpoints about the topic of the screen (i.e. Egypt).

The "Map" option 456 brings the user back to the world map (Figure 13) to select additional sites. The "About This Site" option 458 brings up text, graphics or additional video concerning the site of Giza, Egypt. For example, a professor appears and talks about the origin of the Sphinx (shown by camera 1). The embodiment shown in Figure 16 and described below (interactive lecture) may be combined with the "About This Site" option. Additionally, other video may be displayed in response to selection of "About This Site". Such video may be a documentary of the Sphinx or discussion about the technology that historians estimate was used to construct the Sphinx.

The "About Egypt" option 460 brings up graphics, text or additional video concerning Egypt. For example, a map of Egypt with population densities may be shown. The option for "Upcoming Events" 462 brings graphics, text or video concerning new ev not needed and the data rate is determined by communication equipment 240 automatically. Note that an advertisement 402 is also shown on this screen.

Figure 16 shows an interactive lecture embodiment of the present invention.

As shown in Figure 16, live video 500 of an astronomy professor's lecture is transmitted to connected users. The users are able to ask the professor questions 510 and receive answers 512. The live video 500, questions 510, and answers 512 are shown to all connected users. Preferably, the users enter questions via keyboard or microphone. However, if suitable data rates are available, the user may ask a question via video. Thus a split screen video showing both the person asking the question and the lecturer may be presented to all users simultaneously. The answers are preferably given by the lecturer, who may observe the question on a remote display. Alternatively, the answers may be supplied by the web site as text, graphics, or prestored video. The answer may pass through a closed captioning device, be encoded, and displayed on the screen in an answer box 512.

Referring to Figure 9A, questions are sent to the web site 140 as part of the normal user terminal communication. The web site 140 receives the question at the communications equipment 240 and forwards the question through router 230 and the firewall/ access control unit 254 to the administrative unit 262. The administrative unit 262 determines whether the question can be answered by playing stored video or showing stored text or graphics. If so, the administrative unit 262 directs the database server 256 to recall the appropriate information. The information is then output through the matrix switches 250, 270 or 264 under control of the administrative unit, as appropriate. The ability of the administrative unit to answer questions depends upon the complexity of its software. Simple, prestored answers to frequently asked or standard questions may be provided in a basic system. More advanced systems may utilize an interpreter to analyze the question before providing an answer. For example, frequently asked questions in the astronomy field may be "what is a star?" or "how was the galaxy formed?" In response to these questions, which may even be provided on a menu or list, the administrative unit recalls prestored answers in either video, text, or graphics.

If a question cannot be answered by the administrative unit, or is sent directly to the remote lecturer, the question proceeds to the remote lecturer in a similar fashion as the camera control signal (Figure 3) discussed previously. However, in the interactive lecture embodiment, the camera control unit 268 (Figure 9) is replaced with a question format unit (not shown) which reformats the question under control of the administrative unit 262. Transmitter 210 then transmits a question signal to the location of the remote lecture via the data communication network 120 and the communication paths 126, 128. The lecturer has a display which shows questions received over the data communication network.

In an alternative embodiment, the lecturer or a number of assistants may select from among many prestored answers in response to a question. In this embodiment, the remote lecturer has a computer and monitor (not

shown) which displays the questions and the available prestored answers. The lecturer or assistants then match answers with the questions. The prestored answers are preferably forwarded to the individual who asked the associated question. In order for others to learn from the questions, the questions and answers may be provided to all connected users.

Apparatus for video access and control over computer network, including image correction

Claims of corresponding document: **WO9912349** Translate this text

CLAIMS:

1. An apparatus for communicating audio and video signals to user terminals, the apparatus comprising:
a web site, connected to a plurality of user terminals, comprising:
a means for receiving digitally compressed audio and video;
an audio-video server for providing a plurality of digital video signals;
a means for switching and combining the plurality of digital video signals;
an administrative unit, connected to the means for switching and combining, which directs which signals are switched and combined; and
a means, connected to the switching and combining means, for communicating the digital audio and video signals to the user terminals as video streams.

2. The apparatus of claim 1, wherein the web site further comprises:
an audio and video storage device, connected to the receiving means, which stores at least some received audio and video;
a data storage device, connected to the receiving means, which stores textual and graphical data;
a database server, connected to the administrative unit, the switching means, the audio and video storage device and the data storage device;
wherein the administrative means directs the database server to retrieve and supply to the switching means the audio and video information from the audio and video storage device and the textual and graphical data from the data storage device.

3. An apparatus providing the perception of remote camera control to a user, the apparatus comprising:
a plurality of remote video cameras arranged to film a remote site, each remote video camera providing a video signal of a different perspective of the remote site;
a compressor, connected to the video cameras, which compresses the video signals;
a data communication network, connected to a web site and to the compressor, which carries the compressed video signals from the remote site to the web site;
the web site connected to the communication network and to user terminals, comprising:
a receiver, having the compressed video signals as its input;
an administrative unit which determines which video signals to pass to a user terminal in response to a user command;
a switching means, controlled by the administrative unit, for switching received video signals to communication equipment;
communication equipment, in operative communication with the administrative means, for transmitting the switched video signals to user terminals and for receiving a user command;
wherein a user terminal transmits the user command to the web site and the administrative unit directs the switching means to provide video signals to the user terminal in accordance with the user command thereby enabling a user to remotely control the position or orientation of the video signal being received at the user terminal by entering user commands.

4. An apparatus for providing users actual camera control of a remote video camera, the apparatus comprising:
a remote video camera positioned to provide video signals of a remote site, the remote video camera comprising means, connected to a computer, for moving the orientation or position of the camera;
a compressor, operatively connected to the video camera, which compresses the video signals;
a remote computer, connected to a data communication network and remote camera, which controls the

means for moving, in response to received control signals;
a data communication network, connected to a web site and to the compressor and computer, which carries the compressed video signals from the compressor to the web site and which carries the control signals from the web site to the remote computer;
the web site connected to the communication network and to user terminals, and comprising:
a receiver, having the compressed video signal as its input;
communication equipment, which transmits the received video signal to a user terminal and for receiving a user command from the user terminal;
an administrative unit, in operative communication with the communication equipment, which processes the user command into a control signal and passes the control signal to a transmitter; and
a transmitter, connected to the data communication network, which transmits the control signal to the remote computer;
wherein a user is able to remotely control the position or orientation of the video signal being received at the user terminal by entering user commands.

5. An apparatus for use with a computer network, the apparatus comprising:
a web server, which receives compressed video and outputs one or more video streams to communications equipment;
communications equipment, operably connected to the web server and a plurality of user terminals, and having a plurality of input/output ports and a means for determining the data rate of each connected user terminal, wherein the video streams provided to user terminals are provided at the data rate determined by the determining means.

6. An apparatus for use with the internet, the apparatus comprising:
a remote video camera positioned to provide video signals of a remote instructor;
a compressor, operatively connected to the video camera, which compresses the video signals;
a display, connected to a data communication network, which shows questions from a question signal received over the data communication network;
a data communication network, connected to a web site and to the compressor and display, which carries the compressed video signals from the compressor to the web site and which carries the question signal from the web site to the display;
the web site, connected to the data communication network and to user terminals, the web site comprising:
a receiver, which receives the compressed video signal;
communication equipment, for transmitting the received video signal to a user terminal and for receiving a user question;
an administrative unit, in operative communication with the communication equipment, which processes the user question into a question signal and passes the question signal to a transmitter; and
a transmitter, connected to the data communication network, which transmits the question signal to the remote computer; and
wherein a user is able to ask the remote instructor a question by entering a user question at the user terminal, and wherein the remote instructor is able to view the user question on the display and answer the user question.

7. A system for providing a user with perceived camera control via a web site, comprising:
communications equipment to receive camera control commands from one or more connected users and to transmit video to the one or more connected users;
video of different views of a remote site;
an administrative unit, wherein the administrative unit determines which view of the remote site to transmit to a connected user in response to a received camera control command, thereby providing the connected user with the perception of camera control.

8. The system of claim 7, wherein the system further comprises a video storage unit, wherein the video storage unit supplies video of different views of the remote site to the web system.

9. The system of claim 8, wherein the video of different views of the remote site is video of different camera angles of the remote site.

10. The system of claim 8, wherein the video of different views of the remote site is a distorted wide angle video of the remote site, and wherein the system further comprises a means for removing distortion from at

least one view of the wide angle video.

11. A system for providing a user with actual camera control, the system comprising:
a web site, comprising:
communications equipment to receive camera control commands from one or more connected users and to transmit video to the one or more connected users;
a video receiver for receiving video from a remote video camera;
a transmitter in communication with the remote video camera;
a camera control unit, which outputs formatted camera control commands to the transmitter; and
wherein the camera control commands received from a user are formatted and transmitted to the remote camera and control the remote camera.

12. A system for obtaining and communicating video, comprising:
a means for obtaining video;
a first matrix switch, in operative communication with the obtaining means, which switches the obtained video;
an output device, in operative communication with the first matrix switch, which outputs the switched video;
wherein users receive the video from the output device.

13 The system of claim 12, wherein the means for obtaining includes a receiver which receives video.

14. The system of claim 13, wherein the means for obtaining further includes a video compressor.

15. The system of claim 13, wherein the receiver is a broadcast television receiver.

16. The system of claim 13, wherein the receiver is adapted to receive compressed video over a communication network.

17. The system of claim 12, wherein the means for obtaining comprises an input interface, the input interface connected to a paging receiver.

18. The system of claim 12, wherein the means for obtaining comprises an input interface, the input interface connected to a cable headend.

19. The system of claim 12, wherein the means for obtaining comprises an input interface, the input interface connected to a network controller.

20. The system of claim 12, wherein the means for obtaining comprises an input interface, the input interface connected to a set top terminal.

21. The system of claim 12, wherein the means for obtaining comprises an input interface, the input interface connected to a cable television system.

22. The system of claim 12, wherein the means for obtaining comprises a file server which stores video.

23. The system of claim 12, further comprising a second matrix switch connected to a plurality of video servers, wherein the first matrix switch is in operative communication with the obtaining means via the second matrix switch and the video servers.

24. The system of claim 12, wherein the video is distorted wide angle video, the system further comprising:
an administrative unit which removes the distortion from a segment of the stored video.

25. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to a paging system transmitter.

26. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to a television broadcast transmitter.

27. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to an operations center.

28. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to a cable headend.

29. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to a network controller.

30. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to a network manager.

31. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to a set top terminal.

32. The system of claim 12, wherein the output device comprises an output interface, the output interface connected to a cable television system.

33. A method of remotely viewing a remote site, the method comprising the steps of:
accessing a communications network;
receiving video depicting one or more views of the remote site via the communications network;
entering commands regarding a different view of the remote site;
displaying the different view of the remote site.

34. The method of claim 33, wherein the communications network is the internet, and further comprising the steps of:
addressing a web site on the internet;
selecting a remote site.

35. The method of claim 33, wherein the received video is distorted wide angle video, and wherein the step of displaying comprises the step of removing distortion from a segment of the distorted wide angle video pertaining to the different view to be displayed.

36. The method of claim 33, wherein the received video is video from one of a plurality of remote cameras, and further comprising the steps of:
processing the entered command to select one of the remote cameras in accordance with the commanded different view; and
receiving video of the different view from the selected remote camera.

37. The method of claim 36, wherein the displaying step further includes the step of indicating the location of the selected remote camera and a frame of reference at the remote site.

38. The method of claim 37, wherein the step of indicating further comprises the step of graphically displaying a layout of cameras at the remote site with respect to the frame of reference.

39. The method of claim 33, wherein the displaying step further includes the step of indicating the location of a frame of reference at the remote site.

40. The method of claim 33 wherein the displaying step further includes the step of indicating data concerning the video, the data selected from the group consisting of: remote site location, remote site time.

41. The method of claim 33 wherein the displaying step further includes the step of indicating data concerning the video, the data selected from the group consisting of: magnification, pixel density of the video, number of colors in the video.

42. The method of claim 33, wherein the entered command is a command to monitor the remote site, the method further comprising the steps of:
processing the video for activity at the remote site;
and wherein the step of displaying includes the step of:
selecting views of the remote site displaying activity if activity is present.

43. The method of claim 42, wherein the step of displaying further includes the step of:
automatically panning the remote site if activity is not present.

44. The method of claim 42, wherein the received video is wide angle distorted video, and the step of processing includes the step of removing distortion from at least a portion of the received video to detect

whether activity is present.

45. The method of claim 44, wherein the step of selecting includes the step of choosing segments of the wide angle video for viewing, and the step of displaying further includes the step of removing distortion from the chosen segments.

46. The method of claim 42, wherein the received video is video from a plurality of cameras, and the step of selecting includes the step of choosing one or more cameras for viewing if activity is present.

47. The method of claim 42, wherein the entered command is a command to automatically pan the remote site, and wherein the step of displaying further includes the step of incrementally viewing, for a fixed time, a plurality of different views of the remote site.

48. The method of claim 47, further comprising the step of selecting whether to increase or decrease the fixed time.

49. The method of clam 33, further comprising the steps of:
receiving data and graphics concerning the remote site;
and where the step of displaying further comprises the step of showing the data and graphics.

50. The method of claim 49, further comprising the step of saving the video, graphics, and data in a storage media.

51. The method of claim 33, further comprising the step of saving the video, graphics, and data in a storage media.

52. A method of providing interactive presentations to users, comprising the steps of:
connecting to at least one user via a communications media;
obtaining video of a plurality of remote sites for communication to the user;
receiving a request from the user concerning video at a single remote site;
communicating, via the communications media, at least part of the video concerning the requested remote site to the user.

53. The method of claim 52, wherein the step of communicating comprises the step of compressing video concerning the requested remote site.

54. The method of claim 52, wherein the step of obtaining video comprises the step of retrieving the video from a video storage device.

55. The method of claim 52, wherein the step of obtaining video comprises the step of receiving the video from a communications media.

56. The method of claim 52, further comprising the steps of:
retrieving data concerning the requested remote site;
retrieving graphics concerning requested remote site; and
wherein the step of communicating further comprises the step of providing the retrieved data and graphics to the user.

57. The method of claim 52, wherein the step of obtaining video further comprises the step of acquiring video of a plurality of different views of a single remote site.

58. The method of claim 57, wherein the step of communicating comprises the step of sending video of a single view of the remote site to the user.

59. The method of claim 58, wherein the acquired video is distorted wide-angle video, and wherein the step of communicating comprises the step of removing distortion from a portion of the video.

60. The method of claim 58, wherein the acquired video is video from a plurality of cameras, and wherein the step of communicating comprises the step of sending video from a single camera to the user.

61. The method of claim 52, further comprising the steps of:
receiving a question concerning the remote site;
generating reply data to the received question; and
wherein the step of communicating includes the step of transmitting the reply data to the user.

62. The method of claim 61, wherein the step of generating further comprises the steps of:
presenting the question to a person knowledgeable about the remote site; and
receiving reply data from the person.

63. The method of claim 61, wherein the reply data comprises prestored graphics and text, and wherein the step of generating further comprises the step of retrieving the prestored graphics and text.

64. The method of claim 63, wherein the reply data further comprises prestored video data and the step of generating further comprises the step of retrieving the prestored video data.

65. The method of claim 64, wherein the question is a request for information concerning the remote site.

66. The method of claim 52, further comprising the step of:
receiving information concerning the remote site;
and wherein the step of communicating comprises the step of sending the information to the user.

67. The method of claim 52, further comprising step of:
receiving information concerning the data rate of the user's communications system; and wherein the step of communicating further comprises the step of matching to the user's data rate.

68. A method of providing an interactive lecture to users, comprising the steps of:
obtaining video of a lecturer;
connecting to one or more users via a communications medium;
receiving questions from the users;
presenting the questions to the lecturer;
acquiring the lecturer's response to one or more questions;
communicating the video and the lecturer's response to the one or more users via the communications medium.

[19]中华人民共和国国家知识产权局

[51]Int.Cl[7]
H04N 7/10
H04N 7/14

[12]发明专利申请公开说明书

[21]申请号 98810624.8

[43]公开日 2000年12月27日

[11]公开号 CN 1278384A

[22]申请日 1998.9.3 [21]申请号 98810624.8
[30]优先权
[32]1997.9.4 [33]US [31]08/923,091
[86]国际申请 PCT/US98/18271 1998.9.3
[87]国际公布 WO99/12349 英 1999.3.11
[85]进入国家阶段日期 2000.4.27
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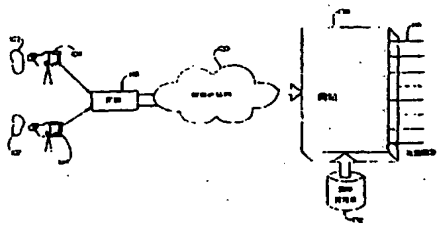
权利要求书21页 说明书36页 附图页数25页

[54]发明名称 通过计算机网络对包含图象校正的图象访问与控制的装置

[57]摘要

本发明涉及传递在因特网上馈送的多个现场图象的方法与装置。用户可以实时观察多个远程地点(102)。在本发明的另一实施例中，用户能遥控远程地点的视频画面。遥控可以是实际控制远程摄象机或用音象数据流的操纵的感觉的遥控。在一个实施例中，正文、图形、及其它图象信息补充提供给教育与娱乐系统的视频画面。按照本发明，正在观看多个视频画面的用户可访问信息。该信息涉及与描述正在观看的事物。拥有带不同数据率的不同类型的设备的用户能接入与使用本发明的系统。在另一实施例中，用户通过提问及接收回答可以与电视教师交互式通信。可将本发明连接到广播与/或有线电视系统上并与之通信。



ISSN1008-4274

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说　明　书

通过计算机网络对包含图象校正的图象访问与控制的装置

涉及申请的交叉引用

本申请要求基于名为“图象访问与控制计算机网的装置”的 1996 年 9 月 9 日提交的美国临时专利申请序号 60/025,604 的优先权，及本申请要求基于名为“包含图象校正的图象访问与控制计算机网的装置”的 1996 年 12 月 20 日提交的美国临时申请序号 60/033,485 的优先权。通过引用将这两个临时申请全文结合在此。

引用结合

此外，通过引用将下列专利、专利申请与公布结合在此：

1996 年 9 月 24 日颁给 Hendricks 等人的美国专利号 5,559,549，

1997 年 2 月 4 日颁给 Hendricks 等人的美国专利 5,600,573，

1994 年 12 月 2 日提交的名为“用于有线电视系统头端上的网络管理程序”的美国未决专利申请序号 08/352,205，

1993 年 2 月 9 日颁给 Zimmerman 的美国专利号 5,185,667，

1994 年 5 月 17 日颁给 Kuban 等人的美国专利号 5,313,306，

1994 年 10 月 25 日颁给 Kuban 等人的美国专利号 5,359,363，

1995 年 1 月 24 日颁给 Martin 等人的美国专利号 5,384,588，

1996 年 2 月 6 日颁给 Richardson 等人的美国专利号 5,489,940，

1996 年 3 月 7 日 Jambhekar 等人公布的 PCT 公布号 WO96/07269，

1996 年 3 月 14 日 Labun 公布的 PCT 公布号 WO96/08105，

1996 年 6 月 13 日 Richardson 等人公布的 PCT 公布号 WO96/18262，

1996 年 7 月 11 日 Harris 等人公布的 PCT 公布号 WO96/21173，

1996 年 7 月 11 日 Harris 等人公布的 PCT 公布号 WO96/21205.

发明背景

本发明涉及通过诸如计算机网与服务器等通信网的音象信号分配。本发明对诸如因特网与全球网等全球网络特别有用。本发明还涉及教育。特别是，本发明提供一种对亲临教室讲授的替代品。

1、发明领域

本发明涉及教育、音象系统、通信系统与计算机网络领域。

为了更多地学习其它人民、文件及我们所生活的环境，全世界的个人互相交换观念与信息。在广播通信媒体上经常传输视频及音频信号向观众提供新闻与娱乐。计算机网用于数据与其它信息的远程交换。广义地说，这些系统试图在地理上分开的个人与单位之间传递有用的知识。本发明总的说涉及改进远程地点之间的信息传输。

2、相关技术的描述

永恒的愿望是改进所有级别上的教育与知识，只在人们增进了彼此的理解及增进了人对自然与环境的理解时，才能达到真正的人类进步。传统上，在学校中从教室讲授及书本阅读中获得教育与知识。

当前教室讲授系统的缺点在于学生必须亲自在教室中参加教学过程。因此，地理上远离教室地点的学生通常不能象教室附近的学生那样经常或适时的参加教室讲授。

教科书的缺点在于它们通常不能跟上最新的事件或技术变化。教科书通常只在逐年或不频繁的基础上更新，而重要的变化可能逐月或更频繁的变化。同时，为了节省资金，即使已更新了教科书，学校也不购买新教科书。因此，新知识虽然可以获得也不传递给学生。

最近，已在教育领域中开始使用音象展示。这些系统可提供出关于教学主题的授课人的录制品的播放。例如，学生可从观看数学教授的授课的录象带或电视广播中学习数学。教学也可以在更不正规的基础上出现。例如，在美国诸如发现频道 R 及学习频道 R（总部设在 Bethesda, Maryland, 美国）等专业频道广播接纳及教育不同观众的教育节目。

这些音象系统的缺点在于它们不是交互式的。学生不能提问题，而授课人不能裁剪其讲授材料来配合当前学生听众的特殊需要。结果，不符合学生的需要。

有线与广播电视是向装有称作“电视机”的接收机的大量观众提供信息的公知的媒体。通过接通广播、有线广播或卫星信号，用户能观看来自遥远地点的场景及观看远离用户的地点发生的新闻事件。然而，传统电视是单向媒体，用户不能在其中互相或与广播员交流。

最近，“因特网”与“全球网”的出现结合个人计算机的迅速扩大允许人们在全球与廉价的基础上交换信息与观念。一般地说，因特网是连接“主”计算机的大型计算网。拥有计算机、调制解调器及电话线的用户通常通过电话呼叫与“主”机连接。与其它主机（连接到其他用户）通信的“主”机能在用户之间传送信息。因特网用于在全世界具有电话接入的实际上任何两点之间例如用于传送数据文件、静止图象、声音与报文。

1981 年以来因特网的使用剧烈的增加，当时只有大约 300 台主计算机连接在一起。1989 年估计连接的主计算机的数目少于 90,000；但到了 1993 年连接一百万台主计算机以上。当前连接了九百四十万台主计算机以上（不包括人们用于通过调制解调器接入这些主机的个

人计算机）以及全球四千万人能访问因特网媒体。1999 年这一数目预期增长到二亿。

因特网上的用户能在远程站点之间传送正文、图形与静止画面。能传输的其它类型信息还有包含预录制的图象序列的文件。为了观看这些图象，用户下载大型数据文件，运行适当软件之后，在计算机屏幕上看见一序列图象。这些图象不是实时提供的，并且在用户正在访问因特网时是不能观看的。

因此，即使因特网是双向通信媒体，当前不能用来提供视频信息及音象演出。这是一个缺点，由于大量人们已习惯电视音象演出，并且比文字或图形显示更喜欢音象演出。

所需要的是交互式的并携带音频、视频、正文及图形的通信媒体。

所需要的是用户友好与有趣的教育系统。

所需要的是从远程站点向用户提供现场直播图象。

所需要的具有提高的真实感与精确性的远程图象系统，使用户感受似乎他们真的出现在该远程站点上。

发明概述

按照本发明，图象是在远程站点上采集的。（这里所用的名词“图象”包括可伴随视频信号的立体声或单声道音频信号。此外，这里广义地使用图象来包含静止图象、相关的静止图象组、动画、图形、画面或其它视觉数据。）远程图象信息可从盒式录象带、CDROM、电视频道、一或多台摄象机或其它知名的源获得。如果使用摄象机，可将它们连接在计算机上，使它们能遥控，或可将它们朝向成能为用户建立可控制的感受。图象可涉及感兴趣的远程站点，诸如埃及的金字塔，或图象可涉及正在远程站点上进行的教学讲授。

将采集的图象以压缩或不压缩的形式传送到网站。图象可物理地运输或通过通信媒体传输到网站。

网站包含可存储一些或全部图象的存储介质。此外，网站适当时可传递控制命令到遥控的摄象机或者可模拟摄象机的遥控。网站的主要功能为响应用户的选择通过诸如因特网等通信媒体传递图象给多个用户。传递给多个用户的图象可以是正在馈送给网站的现场图象也可以是存储的图象。利用若干图象服务器通过诸如因特网等通信媒体输出图象给用户。网站可为包含数据通信设备、或存储器大小等特定用户的硬件剪裁图象，即数据率与用户设备能处理的最高速度匹配。

用户接收与播放从网站发送的图象。可接收许多同时的图象画面。虽然，图象的质量与帧速率取决于用户的通信硬件。拥有高速调制解调器或有线调制解调器的用户接收较高质量图象。用户能发送命令与/或查询给网站。将这些命令与询问提交给远程站点来遥控摄象机或询问位于远处的讲师。此外，命令导致网站从具有不同摄象机角度或位置的许多视频信号中变化（或传输广角图象的不同部分），使用户具有遥控摄象机的感受。用户的命令也可导致显示所接收的广角图象的不同部分，给用户摄象机控制的感受。

除了图象，网站提供诸如图形与正文等与图象相关的信息。这一信息可自动提供或在用户请求时提供。因此，向用户提供关于远程网站的全面信息资金，使用户受到感兴趣的远程站点的快速教育。

<u>附图的简要说明</u>

图 1 为本发明的实施例的框图，其中用盒式录象带或普通电视将远程图象提供给网络服务器。

图 2 为本发明的实施例的框图，其中用位于远处的摄象机及携带

图象的通信网将远程图象提供给网络服务器。

图 3A 与 3B 为采用带有可遥控的摄像机的图 1 与 2 的实施例的本发明的实施例的框图。

图 4 示出位于建筑物周围用于感觉的摄像机控制的远程摄像机。

图 5A、5B、5C 和 5D 示出来自图 4 中所示的特定摄象机的视频图象。

图 6 示出配置成跟随游行路径的远程摄象机。

图 7A 与 7B 示出远处的遥控摄象机。

图 8A 与 8B 示出远处的单个远程摄象机，其中该摄象机具有 180 度球面（或其它广角）镜。

图 9A 与 9B 为服务器平台的框图。

图 10 为从服务器站点到远程用户的通信路径的框图。

图 11 示出按照本发明的实施例的主页。

图 12 示出按照本发明的另一实施例的“团体”页。

图 13 示出全球远程摄象机位置的“地图”页。

图 14 示出包含从 5 台远程摄象机馈入的现场图象的“监视”页。

图 15 示出指向确定用户的数据率的页。

图 16 示出交互式授课的页。

图 17 与 18 示出本发明的实施例的页，其中组合现场图象、预存储的图象、图形及交互式提问。

图 19 示出利用感觉的摄象机控制自动监视与拍摄区域的方法的流程图。

图 20 为示出图象及示出图象数据的本发明的示范性屏幕显示。

图 21 为示出本发明的计算机网络实施例与有线电视系统之间的

交互作用的图。

附图的详细说明

如上所述，本发明涉及从远程站点获得图象及交互式地将该图象提供给用户。图象是在远程站点上获得的，传递给网址（可将它存储在那里），并提交给用户。

1. 从远程站点获得图象，将图象传递给网站，及流送（streaming）图象给用户

图 1 示出本发明的较佳实施例，其中远程图象源为盒式录象带与电视节目。图 1 示出远程站点 102、远程摄象机 104、盒式录象带 106、压缩设备 108、114、数字存储设备 110 及网站 112。如图 1 中所示，电视摄象机 104 用来拍摄远程站点 102 上的活动。如下面讨论的，可在单一远程站点上使用许多摄象机来从不同角度与方向上获取该远程站点的不同视图与声音（最好是立体声）。同时，可利用各拥有其自己的摄象机的许多远程站点，如在 102'、102''及 104'与 104''所示的。摄象机拍摄远程站点上的事件，并将事件录制在盒式录象带 106 或其它适当介质上。

然后将录制的信息运送到网站 112 或与网站 112 通信的站点。如图 1 中所示，然后在压缩单元 108 中压缩来自录象带 106 的录制的信息并将其存储在数字存储介质 110 中。可采用诸如 MPEG-1、MPEG-2 与 Wavelet 等许多压缩算法。本系统中可使用当前可从 Duck 公司、Xing 技术公司、Indeo、数学图象艺术有限公司、VDOnet 公司及 Intel 公司购得的压缩系统。数字存储介质可以是诸如硬盘、CDROM、数字视盘（DVD）、数字带、视频文件服务器或其它介质等任何已知的存储设备。

然后将存储与压缩的声音/图象提供在来自网站 112 的若干流送声音-图象输出端 116 上。这使许多用户能访问存储的图象与声音，并允许一个用户接收许多音频-视频信号，即将显示分成许多“摄象机”馈入。

除了从盒式录象带提供流送声音与图象之外，网站 112 可从电视频道提供声音与图象。用传统的电视接收机（未示出）接收电视信号，用压缩单元 114 数字压缩并通过网站 112 馈送到流送输出中。通常没有必要将电视节目存储在数字存储单元（诸如存储单元 110）中，因为声音与图象是不断地进入与变化的。然而，可将广播电视的某些段存储在存储设备（未示出）中供用户调出。

图 2 示出本发明的另一实施例，其中相同的参照数字指示与图 1 中所示的项目对应的项目。图 2 的系统利用远程摄象机与通信网向网站提供远程图象。图 2 示出远程站点 102、录象机 104、压缩单元 118、数据通信网 120、网站 130、数字存储单元 132 及流送图象 116。

如图 2 中所示，用摄象机 104（如在图 1 中）拍摄远程地点 102。然而，在本实施例中，摄象机 104 的输出通过压缩单元 118。在数据通信网 120 上将压缩的音频与视频传递给网站 130。数据通信网 120 可以是本技术领域中普通技术人员当前所知的任何网络，诸如陆上租用线路、卫星、光纤缆、微波链路或任何其它适用的网络。

其它适用的网络可以是蜂窝式网或寻呼网。在寻呼网中，可将摄象机 104 连接在将图象（包括静止图象）传递给网站 130 的寻呼设备与/或数字存储介质或寻呼发射机上。这里通过引用包含的下列公布公开了相关系统：Jambhekar 等人 1996 年 3 月 7 日公布的 PCT 公布号 WO96/07269；Harris 等人 1996 年 7 月 11 日公布的 PCT 公布号

WO96/21173；Harris 等人 1996 年 7 月 11 日公布的 PCT 公布号 WO96/21205。

本例中的网站 130 适应于接收来自数据通信网 120 的信息。网站可在流送的视频输出 116 上将来自摄象机 104 的图象传递给用户。在另一实施例中，网站可包含解压器以便在将图象流送给用户之前将其解压，或将图象在压缩方案改变到与所连接的用户兼容的一种，此外，图象可在流送的视频输出上压缩而连接在网站 130 上的用户可运行解压软件。网站 130 可在将其提供给流送的输出 116 之前，将在数据通信网 120 上接收的声音与图象存储在数字存储单元 132 中。此外，可将声音与图象直接传递给流送的输出 116。

图 3A 示出本发明的另一实施例，它组合了图 1 与 2 的实施例并增加了摄象机遥控。图 3A 示出远程地点 102、摄象机 104、计算机 134、视频路径 122、129、控制路径 124、126、128、压缩器 108、114、118、136、数据通信网 120、网站 140、数字存储装置 132 及流送的视频 116。如同图 1 与 2，用摄象机 104 拍摄远程地点 102。如同图 1，网站 140 能接收录象带 106，在压缩单元 108 中压缩音频与视频，及存储压缩的音频与视频 110。来自电视台的音频与视频也可用压缩单元 114 压缩及存储或作为流送的视频 116 传递，如在图 1 中。

同样，可将摄象机 104 连接在压缩单元 118 上（如在图 2 中）并通过数据通信网 120 传递压缩的音频与视频给网站 140。从而，可用各种方式在单个网站 140 上组合图 1 与 2 中所示的实施例执行的功能。

图 3A 与 3B 在前面描述的实施例上增加摄象机控制特征。如图 3A 中所示，计算机 134 连接在远程摄象机 104 上。计算机能控制摄象机 104 上的机械或电气设备来改变摄象机的朝向（包括位置与/或角度）。

声音与图象从摄象机 104 传递给计算机 134。可以处理图象并存储在计算机中。最好如图 3B 中所示，将计算机连接在多个远程摄象机 104'及 104''上，以便多个用户可各自控制一台摄象机。计算机 134 可包含压缩器或连接在外部压缩单元 136。压缩来自摄象机 104'与 104''的图象并将其提供给数据通信网 120。网站 140 随后接收这一压缩的图象。可用计算机 134 在路径 124 上传递的控制信号控制远程摄象机 104'、104''（图 3B）。计算机 134 在摄象机控制路径 126 上接收来自数据通信网 120 的控制信号。网站 140 在路径 128 上将控制信息提供给数据通信网 120。本例中的网站 140 适应于传递控制信号给摄象机 104 及将视频图象存储在数字存储装置 132 中。如在其它例中，网站提供若干流送的视频输出 116。

本实施例允许远程用户控制摄象机 104'、104''的角度或朝向。用户连接在网站 140 上并接收来自摄象机 104'、104''的流送的图象 116。如果用户想要向右移动摄象机 104'、104''，他们可在他们的终端上输入用户命令（诸如“向右拍摄”）。网站 140 接收该命令，必要时加以格式化。通过摄象机控制路径 128 将命令作为控制信号输出到数据通信网 120。远程计算机 134 在摄象机控制路径上接收来自通信网 120 的摄象机控制信号。可将远程计算机 134 适应成控制多个地点 102 上的多台摄象机，或在同一地点 102 上的多台摄象机。

计算机 134 通过摄象机控制路径 124 连接在远程摄象机 104 上。这一路径允许来自计算机的控制命令行进到摄象机 104'、104''及控制它们。摄象机 104'、104''可具有用于向左与向右拍摄的计算机控制的旋转电机（未示出），并可具有用于移动推拉镜头的计算机控制的电机（未示出）。这些电机是技术人员知道的并且是当前可购得的。可

在单个地点上设置多台摄象机以允许多个用户同时具有摄象机控制。

在网站上获取与/或存储图象的这一系统是十分灵活的。系统允许用多台摄象机来感觉摄象机控制，一或多台摄象机的实际控制，通过单一摄象机上的广角镜感觉摄象机控制，以及生成全面的交互作用程序。

2. 感觉到的带有多摄象机的摄象机控制

在另一实施例中，如图 4-6 中更清楚地所示，给予用户控制摄象机的感觉。为了达到这一点，在远程地点 102 周围布置多个固定摄象机 104、150、152、153、154、156、158、160、162（图 4）。按照本实施例，呈现给用户的是他们正在控制一台摄象机的角度或位置，而实际上只是将不同摄象机的视频输出传送给他们。图 4-6 更详细地示出这一概念。

如图 4 中所示，正在准备破坏建筑物 146。在建筑物 146 周围布置有连接在计算机 135 上的摄象机 104、150、152、153、154、156、158、160、162。计算机 135 连接在通信网 120 上（未示出）。将来自摄象机 104、150、152、153、154、156、158、160、162 的图象数字化并最好在网 120 上传递之前用连接在摄象机上的压缩器（未示出）或连接在计算机 135 上的压缩器（未示出）压缩。摄象机可以是数字摄象机或连接在模数转换器上的模拟摄象机。

摄象机在周边具体标识为摄象机 150、152、153、154、156、158、160 与 162。为了参照，建筑物在两侧上包含字母“A”与字母“B”，如图 4 与 5 中 144 与 148 上所示。若干另外的摄象机 104 以环形方式布置在建筑物周边附近。摄象机的方式与数目不是关键的，但将控制用户如何感觉“摄象机”的运动。

参见图 4，摄象机 150 面对 A 侧，摄象机 152 在 A 与 B 侧之间，摄象机 153 面对 B 侧而摄象机 154 在 B 侧与 A 侧的对侧之间。摄象机 156、158、160 与 162 布置在更靠近建筑物处，如所示。所有摄象机都包含音频拾音器（最好是立体声的）。此外，所有摄象机连接在计算机 135 上，后者输出压缩的音象信号到通信网 120 并最终到网站。图 4 中的系统可用图 2 或图 3 中所示系统实现。与网站 130、140 通信的任何数目的用户可接收来自这些摄象机的声音与图象。

图 5A 示出提供给连接在本发明的网站上远程用户的图象的典型屏幕视图 150。如所示，用户正在观察来自摄象机 150 的现场图象，它提供 A 侧上建筑物的视图。将命令“工具条”151 提供给用户，其中包含向左拍摄命令“□”向右拍摄命令“□”、向上拍摄命令“□”及向下拍摄命令“□”。“自动拍摄”命令与另一命令（诸如向右拍摄）结合使用。“自动拍摄”命令用于在前面输入的方向上自动移动画面位置。例如，如果在“向右拍摄”之后输入“自动拍摄”，则画面将保持向右拍摄直到压下另一个键或压下默认键（诸如 ESC 键）。“自动拍摄”功能的速度受“速度”命令的控制，后者是与“+”与“-”命令结合使用的。此外，单独使用“+”与“-”命令时，分别控制“推变焦镜头”与“拉变焦镜头”功能。“工具条”命令是通过用户输入设备选择的，后者可以是键盘、鼠标器、跟踪球、遥控器、等等。

当任何用户想要切换摄象机 150 的视图（图 5A）并向右拍摄时，用户起动向右拍摄命令“□”，将其传输给网站 130、140（图 2 与 3）。网站接收该命令，并作为响应，导致将来自位于摄象机 150 右边的摄象机的图象（在本例中为摄象机 152（图 4））传输给用户。然后用

户观察到图 5B 中出现的画面，它呈现为从前一位置（摄象机 150）向右的视图。如果用户继续向右拍摄，则向他提供从摄象机 153 接收的图 5C 视图。用户可以这一方式继续向右拍摄绕建筑物一圈。

此外，用户具有可获得的特殊功能，诸如“自动拍摄”与“变焦”。例如，“自动拍摄”结合“向右拍摄”会导致建筑物在由“速度”功能与“+”及“-”键控制下的速度上的转动。单独使用“+”与“-”键导致视图改变到更靠近的摄象机（“+”）或更远离的摄象机（“-”）。如图 4 中所示，摄象机 156、158、160 与 162 布置得比摄象机 150、152、153 与 154 更靠近建筑物。图 5D 中示出从摄象机 156 获得的“放大”图象。如果没有摄象机布置得更近或更远，可使用数字图象处理来数字地放大或缩小图象的尺寸。控制这些功能的软件可布置在网络服务器或用户计算机上。

从而，用户可获得建筑物 146 的不同视图，似乎它们正在遥控单一远程摄象机的定位。用户可从许多激动人心的透视图观察建筑物的破坏。这一“感觉的”摄象机控制是有利的，因为它允许若干用户“控制”摄象机。可遥控的单一摄象机只能由单一用户控制。从而，本发明适用于大量观众。感觉的控制的真实感直接依赖于摄象机的数目及它们距观察的物体的距离。

因此，当建筑物 146 破坏时，任何数目的用户可围绕建筑物实时拍摄，似乎它们亲临现场。当建筑物破坏时，摄象机拾取破坏的声音，最好是立体声。拥有扬声器连接在他们的计算机上的用户可经历这一破坏似乎身临其境。

图 6 示出以线性方式围绕感兴趣的点布置的若干摄象机 104 的配置，各摄象机连接在计算机 135 上如图 4 中所示。如在图 4-5 中，本

实施例采用可由图 2 或 3 中所示的系统达到的“感觉的”摄象机控制。在本例中，远程地点与感兴趣的点为游行，如元旦游行。如摄象机配置所示，用户可横越游行队伍的长度而无须真正参加。用户可观看他们感兴趣的游行队伍的任何部分，只要他们愿意，无须担心他们已错过了有趣的队伍或彩车。在本例中，摄象机配置只是跟随游行路径。拥有孩子在队伍或彩车中的父母可搜索孩子并在整个游行路线中跟随孩子，而父母在观看时无须在电视上时刻监视游行队伍希望他们的孩子通过观察的摄象机。父母只是随着他们的孩子在游行队伍中的前进“移动”到沿游行路线的不同摄象机。

3. 单一/多台摄象机的实际摄象机控制

图 7A 与 7B 示出另一实施例，其中设置了若干摄象机 160、162、164、166。这些摄象机直接与计算机 170 通信并受其控制。虽然有可能形成一个摄象机环来执行“感觉的”摄象机控制（如在图 4-6 中），所示的实施例使用四台摄象机 160、162、164、166，它们包含用于控制摄象机的定位的电机 105（图 7B）。这些电机受计算机 170 控制。可使用单一计算机 170 或若干计算机 170。图 7A 与 7B 中所示的远程地点与感兴趣的点为例如饮水洼地或沙漠绿洲。访问网站 140 的用户能观察饮水洼地处野生动物的习性的现场图象。摄象机 160、162、164、166 布置在饮水洼地中央的岛上。图 5 的工具条 151 也能用在这一实施例中并使用户能选择摄象机控制命令转圈旋转摄象机或执行诸如变焦等其它摄象机功能。因此用户能接收不同视图与角度，及观察整个饮水洼地。

图 7B 示出图 7A 系统与图 3A 与 3B 中所示系统组合的控制与图象路径。以压缩或未压缩形式在路径 122 上将来自摄象机 160、162、164、

166 的图象传递给计算机 170。计算机 170 将图象传递给通信网 120 供网站 140（图 3A、3B）接收。最好在传送给通信网 120 之前用摄象机 160、162、164、166、计算机 170 或外部模数转换器（未示出）与压缩器 136（图 3A、3B）将图象数字化及压缩。

计算机 170 在控制线 126 上接收摄象机控制命令，如图 3A、3B 与 7B 中所示。必要时计算机 170 将这些命令格式化并传送到附加在摄象机 160、162、164、166 上的控制单元 105。控制单元 105 连接成根据用户指示旋转、变焦或者控制摄象机。

通信键路 124 与 122 可以是有线、无线、数字或模拟的，而计算机 170 可位于地点 102 近处或远处。

图 7A 与 7B 的系统不同于图 4-6 中所示的实施例，因为在图 7A、7B 实施例中分配给各用户一台远程摄象机。由于各用户必须分配有他们自己的可控制摄象机，用户必须为可获得摄象机而竞争。可控摄象机的数目可在单一摄象机到任何数目的范围内，并最好统计地确定为与任何给定时间或高峰时间上访问网络服务器 140 的平均用户数相关。通过使用利用排队、预订与时间限制的已知系统，可减少摄象机的数目。

4. 使用单一摄象机及广角镜的感觉的摄象机控制

图 8A 与 8B 示出另一实施例，只使用单一摄象机，其中无限制数目的用户可观察远程地点 102 的任何部分。这一实施例采用与摄象机 180 光学连通的球面镜 182。图 8 中所示的远程地点 102 为如图 7A 与 7B 中的远程饮水洼地绿洲。

如图 8A 中所示，摄象机 180 具有提供 180° 球面（或其它广角）视野的球面（或其它广角）镜 182。传递给计算机 184 的这一视野中

包含畸变。计算机 184 传递与压缩畸变的图象回网站 130 或 140，后者存储并可处理该图象。不是使用计算机 184，而是可使用简单的发射机将整个球面图象传递给网站 130、140（图 2 与 3）。通过使用适当的图象处理软件，网站去掉桶形畸变并存储关于整个球面视野的数据。然后用户便可访问 180° 球的不同部分。在这一实施例中，也使用图 5 的工具条 151。通过使用工具条 151，用户可跨越球面视野移动并获得摄象机控制的“感觉”。本实施例的优点在于它只使用一台远程摄象机便能同时提供给任何数目的用户摄象机控制的感觉。

图 8B 示出图 8A 中所示的系统的另一实施例。如图 8B 中所示，摄象机 180''使用球面（或其它广角）镜 182，前者传送视频信息给计算机 184。计算机 184 在通信网 120 上传递图象给网站 130。网站 130 可存储或处理接收的图象，并通过在通信网 125 上传递图象而使在用户终端 302、304、306、308、310 上的用户可获得该图象。下面相对于图 10 更深刻地说明通信网 125。

因为广角镜产生畸变，在畸变的图象上进行处理而从一段图象中去掉畸变。这一处理可在计算机 180 或网站 130 上执行，但最好在用户终端 302、304、306、308、310 上执行。

从而，网站 130 具有供发送给用户的可获得的广角图象。用户一次只显示与观看一段广角图象。然后通过使用工具条 151（图 5），用户可选择图象的邻接段供观看。当用户选择图象的邻接段供显示时，处理该邻接段以去掉畸变然后显示。显示邻接段给人以将摄象机物理地“移动”到原先的段的邻接的侧面的外观。

用于电子地消除从鱼眼镜头获得的图象中的一段中的畸变的一个系统公开在 1993 年 2 月 9 日颁给 Zimmerman 的美国专利号 5,185,667

中，通过引用结合在此。Zimmerman 的装置使用下述硬件来处理捕捉与数字化的图象：连接在遥控器、计算机控制、X 图及 Y 图上的微型计算机；连接在 X 图与 Y 图上的带有连接在图象滤波器的输出端的输入图象缓冲器及输出图象缓冲器。例如，这一硬件或任何其它适当硬件可放置在计算机 184 或网站 130 上，但最好位于用户终端 302、304、306、308、310 处。

作为更好的替代品，去掉专门化的硬件，而将硬件功能实现在计算机 184 或网站 130 上的软件中，但最好将软件加载到用户终端 302、304、306、308、30 中。从而，按照本发明，将球面（或其它广角）图象提供给用户终端，后者执行适当的软件（可以是浏览器应用程序的“插件”）无畸变地显示图象（或视频）的一段。此外，可在用户终端或网站上将畸变的球形图象（或视频）保存在存储介质上，供以后加载与观看。

图 8B 还示出如何无须特殊处理去掉透镜畸变。如图 8B 中所示，球面（或其它广角）镜 182 与摄象机 180'光学连通。然而，将非线性成象传感器 186 置于球面镜 182 与摄象机 180'之间。将该成象传感器设计成提供对消球面镜 182 的畸变的畸变的输出，并从而将不畸变的广角图象提供给摄象机 180'。此外，成象传感器 186 本身可提供数字输出而没有必要使用摄象机 180'。在这一情况中，可将成象传感器 186 直接连接在计算机 184 上。

成象传感器 186 的实例公开在 1996 年 2 月 6 日颁给 Richardson 等人的美国专利号 5,489,940 及 1996 年 6 月 13 日 Richardson 等人公布的 PCT 公布 WO96/12862 中，通过引用将每一件结合在此。其它适当的成象传感器也可用于本发明。

成象传感器 186 获得的图象可以是不畸变的并无须进一步处理。然后通过简单地将图象数据传递给显示设备而选择一段图象供显示。如果成象传感器是不完善的，可进行进一步处理来校正传感器中的缺陷。此外，可进行“变焦”与“不变焦”的进一步处理。这一进一步处理可在网站 130 或用户终端 302、304、306、308、310 上进行。

图 5 至 8 的实施例可结合现场声音与图象或预录制的图象数据(带声音）使用（图 1-3 中所示）。例如，如果在饮水洼地上未发生有趣的事件，则连接的用户可访问前一天发生的狮子攻击的存储的声音与图象剪辑片断。如果利用”感觉的“摄象机控制，则存储的声音与图象最好包括所有摄象机角度（或广角视野），以便保持拍摄与变焦的能力。

5. 网站配置

图 9A 与 9B 示出作为网站 140（图 3）列出的网站的更详细的视图，但它也可对应于网站 112（图 1）与 130（图 2）。网站 140 连接在数据通信网 120、因特网 242 与直接连接 244 上。网站包含发射设备 210、接收设备 220、220’、两个压缩单元 108、114、网络服务器 220、路由器 230 及通信设备 240。网络服务器 200 本身包含数字矩阵开关 250、多个数字视频服务器 252、252’、252’’、252’’’、防火墙接入控制单元 254、数据库服务器 256、音频与视频存储单元 258、数据存储单元 260、管理单元 262、数字矩阵开关 264、摄象机控制单元 268 及数字视频矩阵开关 270。

网站 140 用发射设备 210 与接收设备 220 连接在数据通信网 120 上。如所示，可使用多个接收机 220、220’。也如所示，接收机可具有一个以上视频输出端。也能用盒式录象带（或其它适当的录制介质）

或简单地馈入电视节目将音频或视频信号输入网络服务器 200。如在图 1 与 3 中，最好用压缩单元 108、114 压缩这些信号。在相对侧上，网络服务器 200 用路由器 230 与通信设备 240 连接远程用户，前者又连接因特网 242 或直接连接 244 用户。通信设备 240 通过若干输入/输出端口输出视频流 116。

如上所述，网络服务器 200 包含数字矩阵开关 250、多个数字视频服务器 252、252'、252''、252'''、防火墙接入控制单元 254、数据库服务器 256、音频与视频存储单元 258、数据存储单元 260、管理单元 262、数字矩阵开关 264、摄象机控制单元 268 及视频矩阵开关 270。

数字矩阵开关 250 接收来自接收机 220、220'与压缩单元 108、114 的所有进入的压缩视频信号。矩阵开关 250 还接收来自数据库服务器 256 的压缩视频数据。在管理单元 262 的控制下，数字矩阵开关 250 将输入的压缩视频信号输出到数字视频服务器 252、252'、252''、252'''。以这一方式，可将任何输入信号传送到管理单元指向的任何视频服务器。同时，将来自数据库服务器 256 的存储的节目路由选择到数字矩阵开关 250 去转接，似乎它是进入的现场图象。数字矩阵开关 250 的输出端也连接在数字库服务器 256 上，从而诸如进入的现场声音与图象等输入端上的任何事物都能存储在数据库服务器 256 中。

将压缩的输入图象传递给各种数字视频服务器 252、252'、252''、252'''供格式化。连接在网络服务器 200 上的用户最好运行他们自己的解压软件以便在网络服务器 200 上无须进行解压。作为替代，数字视频服务器可解压输入的视频信号。

将来自视频服务器 252 的音频与视频传递通过第二数字（视频）矩阵开关 270。由于在数字矩阵开关 250 上已进行转接，第二视频矩

阵开关 270 并非必要的，但为了最大灵活性而需要它。当用户数超过视频输入数时它也是最优的，由于可将一个输入引导到许多连接的用户。

在较佳实施例中，矩阵开关 270 可包含连接不同的视频与音频帧的处理器使得各输出包含多个视频画面（包含音频）的帧。这使用户能接收分裂的视频屏幕图象及选择一个音道供播放（见图 14，下面讨论）。可用已知的方法形成分裂屏幕图象，这些方法取决于所使用的压缩类型而有所不同。例如，数字图象可以解压，与其它解压的图象组合，然后再压缩；数字图象可以解压，与其它解压的图象组合，然后再解村缩；或者图象可以解压并转换成模拟，组合，然后转换成数字与压缩供传输。

视频矩阵开关 270 转接的信号最好是数字的。这是因为传递的视频流 116 最好是数字的。最好在数字域中处理网络服务器中的所有信号以增进简单化及保持最大灵活性。

将来自视频矩阵开关 270 的各种视频输出流传递给防火墙接入控制单元 254 供输出到路由器 230 及通信设备 240。

使用这一系统，任何用户可接收出现在任何输入端上的任何信号，包含存储在音频与视频数据库 258 或数据存储单元 260 中的信号。此外，可将出现在数字矩阵开关 250 的输入端上的任何压缩数字信号存储在音频与视频存储单元 258 或数据存储单元 260 中。这在其中的网络服务器 200 在用户请求时必须输出不同的视频画面给用户的感觉的摄象机控制实施例（图 4-8）中是有利的。当网络服务器 200 接收用户请求时，管理单元 262 指导矩阵开关 250 与 270 输出正确的视频流给该用户。如果用户请求存储的图象，管理单元指导数据库服务器

256 提供图象给数字矩阵开关 250。如果要求图形或文字数据，管理单元 262 便指导数据库服务器 256 输出正文或图形给数字矩阵开关 264。

虽然示出为一个功能框，数据库服务器 256 可用若干服务器与/或多端口服务器实现。音频与视频存储单元 258 与数据存储单元 260 可用诸如光学存储器件（即 CD-ROM）、磁盘、磁带或存储器电路（即 RAM/ROM）等许多不同类型的存储介质实现。单元的数目取决于存储的数据量、用户数及希望的输出速度。数据库服务器 256 可以是一或多个单元。音频与视频存储单元 258 存储（最好是压缩的）音频与视频演出，包含所有相关摄象机角度。视频服务器 252 也可作为一或多个服务器与/或多端口服务器实现。

数据存储单元 260 用于存储关于音象显示的信息。这一信息涉及传递给连接的用户的菜单结构与屏幕显示。存储的信息也可具体涉及当前正在显示与聆听的声音与图象。例如，在图 5 中的破坏实施例中，用户可点击“更多信息”图符来获取关于破坏的信息。可能包含诸如炸药统计的信息可作为正文或图形存储在数据存储单元 260 中。将“更多信息”命令传输给通信设备 240，通过路由器 230 及防火墙接入控制 254 到管理单元 262。然后管理单元 262 指示数据库服务器 256 从数据存储设备 260 调回诸如炸药统计等相关信息并将其传递给数字矩阵开关 264。然后将调回的信息传递给防火墙接入控制单元 254、路由器 230 及通信设备 240 供传输给适当的用户。在防火墙接入控制单元 254 中可将数据与声音及图象组合或分开传输。

在感觉的摄象机控制实施例中，通信设备 240 将用户命令（如“向右拍摄”）提交给路由器 230，后者检测该命令并将其提交给防火墙

接入控制单元 254，后者又将其传递给管理单元 262。管理单元 262 控制馈送给各连接的用户的图象。管理单元 262 还响应用户命令指令矩阵开关 250 或矩阵开关 270 之一将来自另一源（例如当前摄象机右边的摄象机）的不同音象信号传递给连接的用户。如果用户正在接收来自数据库 258 的存储的图象，管理单元指令数据库服务器 256 调回适当的视频信号。

在实际摄象机控制实施例中（图 3 与 7 中所示），通信设备 240 接收来自用户的命令（诸如“向右拍摄”）并将其提交给路由器 230。这些命令通过防火墙接入控制单元 254 进入网络服务器 200 并被传递给管理单元 262。命令可以存储在管理单元 262 中或传递给数据库服务器 256。命令传递通过摄象机控制单元 268 时，必要时被格式化供摄象机遥控。将格式化的命令传递给传输单元 210。传输单元 210 将命令提供给数据通信网 120 供在远程摄象机与 CPU134（图 3）上接收。

在球面（或其它广角）镜实施例（图 8A 与 8B 中所示）中，其中的远程摄象机使用球面镜 182，管理单元 262 确定要将音象的哪一段或四分之一响应用户的命令提供给该用户。在这一实施例中，在输出到数字矩阵开关 250 之前，球面图象是存储在数据库 258 中的。图象被分裂成若干段，将它们组合时构成完整的 180° 球面。通过使用适当的图象处理软件，消除或减少各段中的畸变。管理单元 262 响应用户命令确定应将球面的哪一段发送给用户。然后管理单元指示数据库服务器 256 检索与输出正确的段到数字矩阵开关 250。通过控制数字矩阵开关 250 与视频矩阵开关 270，管理单元 262 能够保证用户接收球面图象的正确的段。

然而，如上所述，在一个较佳实施例中将整个球面（或其它广角）

图象传递给用户，而用用户终端上的软件消除畸变，这使网络 140 上所需的处理的复杂性最小，并允许用户存储整个球面（或其它广角）图象。

最好将通信设备 240 设计成自动确定能将信息传输给连接的用户的最大数据率。这一数据率依赖于网站与用户拥有的连接的类型，及用户正在操作的设备类型。在一个实施例中，通信设备使用从用户通信中感测到的最大可能数据率。此外，用户可在被菜单屏面提示时输入他们的数据率，如图 15 中所示及下面描述的。然后将数据率存储在通信设备 240 中。通信设备 240 也可在传输之前用任何已知压缩算法压缩视频流。此外，通信设备最好在压缩前消除图象帧，使得出的数据率降低到与用户兼容。

图 9B 与图 9A 相同，但包含输入接口 225 与输出接口 235。输入接口 225 用于从诸如寻呼系统、蜂窝式系统、有线电视系统等其它源获得数字图象。输出接口将网站连接到诸如寻呼系统、蜂窝式系统或有线电视系统等其它通信系统上。在输入接口连接在模拟系统的情况中，它包含适当的模数转换器（未示出）。同样，当输出接口连接在模拟系统上时，它包含适当的数模转换器（未示出）。

例如，输入接口 225 可获取来自寻呼系统的图象或视频，而输出接口 235 可连接在寻呼系统上将视频或图象广播给有选择的呼叫接收机。这一方面，通过引用包含下述公布，它们的每一种将视频/图象关联到有选择的呼叫接收机：1996 年 3 月 7 日 Jambhekar 等人公布的 PCT 公布号 WO96/07269、1996 年 7 月 11 日 Harris 等人公布的 PCT 公布号 WO96/21173 及 1996 年 7 月 11 日 Harris 等人公布的 PCT 公布号 WO96/21205。

6. 对用户终端的通信

图 10 示出用户如何连接在网站上，并详细示出通信网 125（图 8B）的实例。图 10 中所示的连接应用在前面的图中的网站上，其中包含网站 112（图 1）、130（图 2）与 140（图 3 与 9）。图 10 示出服务器平台 200、因特网 242、两个直接连接 244、两台传统因特网主机 272、274、两台有线因特网主机 276、278、电缆设备 286、288、卫星系统 290 及多个连接的用户终端 302、304、306、308、310。

操作中，网站 112、130、140 可在因特网 242 上连通到若干不同的系统。这些系统包含传统的因特网主机 272、274 及电缆头端因特网主机 276。传统的因特网主机 272、274 可通过电话线 282 或 ISDN 信道 284 分别连接到多个远程用户终端 302、304 上。有线因特网主机 276 可通过电缆设备 286 连接到远程用户 306。

此外，网站通过直接连接 244 连接到电缆头端因特网主机 278 或基于卫星的因特网主机 280。电缆头端因特网主机 278 连通到电缆设备 288 与远程用户终端 308。基于卫星的因特网主机 280 通过卫星 290 连通到用户终端 310。这些直接连接 244 能用较高的数据率及使用高速电缆调制解调器。

通信设备 240（图 9）能与不论数据率或系统如何的任何类型用户终端通信是有利的。当然，具有较高数据率的用户终端将接收较高质量的声音与视频图象。

7. 示范性屏幕显示与特征

图 11-6 示出在远程用户终端上示出的显示页的实例。这些页是作为图形与/或文字信息存储在数据存储单元 260（图 9）中的。

图 11 示出利用本发明的优点的主页的实例。主页 400 包含若干

广告 402、许多网络链路 404、团体链路 406、观看电视节目的选项 408、多个快速访问项选项 409，其中包含“全球现场观看”选项 410 及俱乐部选项 412。

广告 402 对主页供应商产生利润是有用的。如上所述将系统设计成能在因特网上提供电视节目。用户可通过选择主页电视选项 408 观看电视节目。杂志 404 用于提供有关特定专题的信息给用户。用户可通过“团体”选择 406 参加具有附加会员利益的团体。当用户想要观看来自远程地点的现场图象时选择作为快速访问项选项 409 的一部分的“全球现场观看”。想要获得关于感兴趣的公共区域的用户选择俱乐部选项 412 中所示的俱乐部。

图 12 示出团体菜单 406，它是从图 11 主菜单页选择的。如图 12 中所示，其中有“全球现场观看”选项 420、广告 402、订阅信息 424 及许多俱乐部选项 422。可在订阅或暂时免费的基础上提供这一屏幕及响应显示的选项所选择的所有功能。

图 13 示出“全球现场观看”菜单 440 的实例。这一菜单用于选择观看现场或预先录制的图象的远程地点。在这一实例中，提供了带可用来选择观看现场图象的地点的世界地图。屏幕指示活跃 442 或正在建筑 444 中的地点。这一菜单也包含两则广告 402。

“全球现场观看”实施例允许连接的用户访问世界上几乎任何地方以学习关于其文化、地理或环境的更多知识。与感觉的或实际的摄象机控制及相关预先录制的图象、文字及图形信息相结合，实现了强有力而廉价的学习工具。这在图 14 中更紧密地示出。

图 14 示出对应于图 13 中埃用站点的菜单 450。这一屏面关注“GizaEgypt”并包含来自 5 台摄象机的现场图象。如该屏面中所示，

具有第一摄象机 452、第二至五摄象机 454、“地图”选项 456、“关于这一地点”选项 458、“关于埃及”选项 460、“即将到来的事件”选项 462 及“遥控”选项 464。第一摄象机 452 是主要观看摄象机的默认项。用户可选择视频图象尺寸及要显示的图象数目，但这受到用户正在操作的设备的限制。来自第二至五摄象机的图象与来自第一摄象机的一起提供以提供关于该屏幕（即埃及）的主题的替换地点与视点。

“地图”选项 456 将用户带回到世界地图（图 13）去选择另外的地点。“关于这一地点”选项 458 给出关于地点 Giza, Egypt 的文字、图形或附加图象。例如，教授出现并谈论关于狮身人面像（摄象机 1 所示）的起源。图 16 中所示并在下面描述的实施例（交互式讲授）可以与“关于这一起点”选项组合。此外，可响应“关于这一地点”的选择显示其它图象。这一图象可以是狮身人面像的文献或关于历史学家估计用来建筑狮身人面象的技术的讨论。

“关于埃及”选项 460 提出关于埃及的图形、文字或附加图象。例如，可示出带有人口密度的埃及地图。“即将到来的事件”选项 462 带来关于埃及的新事件的图形、文字或图象。例如，显示关于构筑新的灌溉渠的文字与报纸文章。

“遥控”选项 464 给出命令菜单（诸如图 5A-D 的“工具条”151）允许用户在任何能有这一效果的摄象机中改变摄象机角度或定位。菜单应用在实际或感觉的摄象机控制。例如，用户可围绕狮身人面像拍摄（452 所示的摄象机 1）从正面每一侧及背面观察它。

从而关于埃及的这一单一屏幕在单一因特网地址（或网站）上提供信息资源。用户不必“链接”到因特网上其它位置。显示了音象表

示，给予用户深入了解埃及人民与文化。正文、图形与附加的存储图象可用来进一步教育用户。摄象机控制（实际或感觉的）给予用户在埃及的不同地方走动的感觉。

图 15 示出屏面 470，它询问用户关于他们的设备以便确定适当的通信数据率。最好不需要这一屏面而用通信设备 240 自动确定数据率。注意这一屏面上也示出广告 402。

图 16 示出本发明的交互式授课实施例。如图 16 中所示，将天文学教授的授课的现场图象 500 传输给连接的用户。用户能向教授提问 510 及接收解答 512。现场图象 500、问题 510 与解答 512 显示给所有连接的用户。用户最好通过键盘或麦克风输入问题。然而，如果或获得适当的数据率，用户可通过图象提问。从而可将显示提问者与授课者双方的分开的屏面图象同时提供给所有用户。最好由授课者给出解答，他可在远程显示器上观察问题。此外，可由网站作为正文、图形或预先存储的图象提供解答。解答可通过闭路字幕设备传递，加以编码，并显示在屏面上解答框 512 中。

参见图 9A，将问题作为正常用户终端通信的一部分发送到网站 140。网站 140 在通信设备 240 上接收问题并通过路由器 230 与防火墙/接入控制单元 254 将问题提交给管理单元 262。管理单元 262 确定是否能用播放存储的图象或显示存储的正文或图形来回答问题。如果是，管理单元 262 指示数据库服务器 256 调出适当的信息。然后在适当时在管理单元的控制下通过矩阵开关 250、270 或 264 输出该信息。管理单元回答问题的能力取决于其软件的复杂程序。基本系统中可提供对经常提问的或标准问题的简单的预先存储解答，更高级的系统可利用解释程序在提供解答以前分析问题。例如，天文学领域中经常提

出的问题可以是“什么是恒星？”或“银河系是怎样形成的？”在回答这些问题时，甚至可在菜单或表上提供，管理单元调出图象、正文或图形形式的预先存储的解答。

管理单元将不能回答的问题直接发送到远程授课者，以类似于上面讨论的摄象机控制信号（图 3）的方式将问题提给远程授课者。然而，在交互式授课实施例中，用问题格式化单元（未示出）替换摄象机控制单元 268（图 9），前者在管理单元 262 的控制下重新格式化问题。然后发射机 210 通过数据通信网 120 与通信路径 126、128 传输问题信号到远程授课地点。授课者拥有显示在数据通信网上接收的问题的显示器。

在另一实施例中，授课者或若干助教可从许多预先存储的解答中进行选择来回答问题。在这一实施例中，远程授课者拥有计算机及显示问题与可得到的预先存储的解答的监视器（未示出）。然后授课者或助教将解答与问题匹配。最好将预先存储的解答提交给提出相关问题的个人。为了使其他人从问题中学习，可将问题与解答提供给所有连接的用户。

图 17-18 示出使用现场图象、存储的图象、存储的图形、摄象机控制与交互式提问的组合的本发明的实施例。图 17 中所示的摄象机 1 的现场图象 550 涉及地质站点，即喷泉“OldFaithful”。由于该站点位于国家公园中，已将显示器屏幕定制成允许选择“关于国家公园”604。当选择了它时，便将用户命令传递给网络服务器 112、130、140 供管理单元 262 分析。管理单元 262 确定需要预先存储的图象与图形并指令数据库服务器 256 输出正确的信息：图象到矩阵开关 250 及图形到矩阵开关 264。在管理单元 262 的控制下，矩阵开关 250、270 与

264 通过通信设备 240 将图象与图形提交给用户。

图 18 示出用户终端上的结果。屏幕上显示公园看守人的传递的预先存储的图象 560。公园看守人讨论国家公园的课题。讨论结合所有国家公园的位置的图形显示进行，如在屏幕位置 570 上所示。

用户可选择其它选项，诸如“地图 600”以返回到所有远程站点的地图，“关于这一站点”602 来学习关于当前观察的站点的更多内容，“更多关于国家公园”614 来得到关于国家公园更多的信息，“即将到来的件”606 用于即将到来的事件的日程，“遥控”608 用于遥控（实际或感觉的）摄象机（即摄象机 1），“提问”610 用于向在线公园看守人提问（如图 16 中），及“其它主题”612 用于其它主题与/或选项的表。

因此，本发明通过组合现场图象、预先存储的图象、图形及正文与交互式提问及实际或感觉的摄象机控制提供一种容易与有趣的学习方式。

8. 监视系统

本发明可用于监视或跟踪系统。例如，研究人员可放置摄象机在饮水洼地中央，最好连接在录象机上用于存储饮水洼地上许多小时的活动。最好使用多台摄象机或广角镜，使得能在图象上执行虚拟的摄象机控制（如上面所述）。这一监视系统具有许多优点。

首先，系统能自动扫描观测区而无须移动任何摄象机。此外，可以在同时分开的屏幕图象上观察监视区中的多段。要做的一切只不过是消除图象的多段中的畸变（如果采用广角镜）。通过引用结合在此的 1994 年 10 月 25 日颁给 Kuban 等人的美国专利 5,359,363 的公开了可用于本监视系统的一个实例。

第二，可实行自动监控与/或跟踪。通常，研究人员与摄影师在出现期望的事件之前要等待长的无活动时段。例如，摄影师要等待数小时狮子或其它野生动物才能接近摄影师的位置。本发明可用来自动监视远程活动区。在这一情况中，处理器可监视多台摄象机或数字广角图象中指示期望的事件的象素改变。例如，在本来是静寂的荒芜环境中靠近的狮子将在摄象机的输出广角图象中形成一个运动的图案。处理器可检测到该图案并提醒野生动物研究人员正在发生事件。

此外，处理器可自动与连续地显示相关的摄象机输出或包含狮子的广角图象的段，借此跟踪该狮子。从而，本发明可对获得的数字图象使用先有技术中已知的跟踪技术。

在本发明的监视与跟踪实施例中，在执行处理以判定是否正在发生事件之前可能希望从广角图象中消除畸变。正在监视的事件的类型与正在跟踪的对象的性质控制是否要在畸变还是不畸变的图象上进行监视与/或跟踪。本技术中的普通技术人员将选择最适当于特定监视事件或跟踪对象的系统。

图 19 示出使用本发明的监视与跟踪系统的流程图。执行监视/跟踪功能所必需的软件可位于网站或用户终端上。监视与/或跟踪要处理的图象/视频信号可以是馈入或从存储的图象播放的现场图象。从而，野生动物科学家使多台摄象机整夜运转（或带有广角镜的单一摄象机）并在播放录象带时显示包含活动的段/摄象机。

参见图 19，执行“输入参照帧”例程 700。这一例程是任选的，并用于建立诸如北的参照方向的帧。参照帧可确定要观看的广角图象的第一段，或要观看的第一摄象机。下面执行“复位段计数器”例程 710。这将该段或摄象机设定为首先显示的。

在观看下一段或摄象机之前只观看各段或摄象机有限的时间。从而在切换段或摄象机时，执行“复位定时器”例程 715 来复位时间间隔。

下面执行“获取图象”例程 720。这一例程获取广角图象（现场或预先录制的），或来自所有摄象机的图象（在图 4 与 5 的多摄象机感觉的控制实施例中）。取决于正在监视的对象，可以处理从广角镜获取的图象以消除畸变或者不处理。

处理所获得的图象来确定活动区（摄象机或段）。活动区是处理器通过这些位置上象素中的改变、使用其它已知的图象/视频处理技术或通过使用外部传感器确定的发生活动的区域。这一处理的执行是本技术中已知的，在此不作进一步描述。这一处理在“活动的处理”例程 730 中发生。这一例程使用参照帧相对于正常（即北）方向确定活动的段。

如果存在活动，“显示活动段”例程 750 在显示器上显示活动的段或摄象机。在广角镜实施例中消除来自相关的段的畸变。如果一段以上是活动的，分屏显示可同时显示各段。各分屏显示可参照前面在例程 700 中输入的参照帧。然后执行“复位计时器”例程 710，使得在不再存在活动时返回受观察的上一段。

如果不存在活动，执行“显示当前段”例程 760。这一例程显示当前段或摄象机直到定时器到时，这时显示下一段或摄象机。显示可参照前面在例程 700 中输入的参照帧。

在显示当前段或摄象机之后，执行“超过时限”例程 770。如果尚未超过时限，产生到“获取图象”例程 720 的分支及继续处理直到超过时限，或直到出现活动。在“自动拍摄”实施例（图 5）中，可

通过按压“-”按钮结合“速度”按钮（图 5）为较慢的自动拍摄增加时限值，而通过按压“+”按钮结合“速度”按钮（图 5）可为较快的自动拍摄减少时限。

如果超过了时限，“增量段计数器”例程 780 增量段（或摄象机）计数器。如果计数器大于摄象机或段的最大数目，“计数器>最大值”例程 790 分支到“复位段计数器”例程 710，重新起动自动拍摄。如果计数器不大于允许值，分支产生到“复位定时器”例程 715，以便可以显示下一段或摄象机，并继续活动处理。

从而，图 19 的流程图允许自动拍摄及自动跟踪。如果去掉“活动处理”例程 730、“活动？”测试 740 及“显示活动段”例程 750，则可达到前面相对图 5 描述与示出的“自动拍摄”功能。在这一情况中，“显示当前段”例程 760 将在“获取图象”例程 740 后面。

可将监视与自动拍摄组合。组合时，将所有活动段或摄象机自动拍摄一个短的时帧。从而，如果狮子与斑马从相对方向一起向摄象机移动，在切换到其它显示之前各显示一个短的时帧。这是对前面描述的分屏显示的替代品。

9. 图象数据的显示

在本发明的某些实施例中，用户可选择或接受关于当前显示的图象的数据。例如，可将录制图象的日期与时间、图象位置的名称、图象的剩余时间、或关于正在观看的图象的段（或摄象机源）的数据叠加在图象上。

这一段/摄象机数据可以是指北针方位（诸如北）或从基准的角度（诸如 40° ）、或关于当前显示的段/图象的中心位置相对于广角图象或其它摄象机的坐标信息（诸如 X/Y、X/Y/Z、R/Θ、X/R/Θ等）。

镜头（或摄象机的布置）的图形表示可示出正在显示广角图象的哪一段（或摄象机）。为了显示该图象段，可采用参照帧，尤其是对于球面镜。参照帧可用网站或用户终端上的处理器生成，或由用户或操作员输入。例如，用户可选择哪一方向是“北”或坐标系统的轴的位置，如果要为特殊的镜头使用坐标显示。

此外，也可在显示器上示出图象的放大倍数及其密度/彩色，诸如“放大倍数＝10x，画面密度=200×200 象素，64 色”。

本发明的所有实施例中都可使用图象数据显示，并最好在显示的图象改变时将其更新。

图 20 示出显示珊瑚礁 805 的示范性显示器 800，其中用户拥有通过多台水下摄象机的虚拟摄象机控制。在屏幕 807 上，显示日期 810 与时间 820。位置示出在 830 处，而节目的剩余时间在 840 处。放大倍数示出在 850 处，而密度与彩色在 860 处。段摄象机字段 870 示出用于正在观看三号摄象机。这一段/摄象机数据可用图形显示，如在 880 处描绘的。字段 880 是珊瑚礁 805 的顶视图及摄象机的布置，在本例中为摄象机 1 至 10。三号摄象机周围的方框表示这一摄象机是显示器 800 上的画面的源。890 上指示图形段数据的参照帧（北）而 895 指示图象数据的参照帧。

10. 存储图象与交互式展示

也可将图象、视频与图象数据存储在用户终端（或接收装置）上。最好将广角畸变图象与图象数据（如果存在的话）一起存储。图象与图象数据的存储使用户能在稍后的日子检索图象并观看一段。可选择地，可将整个交互式展示存储在用户终端上（包含相关的图形、正文、图象、数据或其它信息），虽然所有相应的文件与数据都必须由用户

接收。

通过引用结合在此的 1996 年 3 月 14 日 Labun 公布的 PCT 公布号 WO96/08105 的公开涉及存储图象并可用于本发明。

视频或图象可从其畸变或不畸变状态存储。以其不畸变状态存储视频或图象具有如下的优点：高与/或宽的画面能以它们最可观赏的状态存储，以及如果它们是以消除畸变检索的，便能更容易地在图象上执行编辑。

11. 广播电视与有线电视

本发明的感觉的摄象机控制也可用于广播电视领域或有线电视领域。

不是通过因特网将广角图象（图 8A 与 8B）提供给终端，而是发射机可将图象广播给视频接收机。电视接收机装有解码器来解码广角图象，如只是作为示例，在 1995 年 1 月 24 日颁给 Martin 等人的美国专利号 5,384,588 中所公开的，通过引用将其结合在此。广播电视发射机（未示出）可连接在远程摄象机 104（图 1-3）、输出接口 235（图 9B）、因特网主机 272、274、276、278、280（图 10）、通信介质 120、125（图 8B）或甚至用户终端 302、304、306、308、310（图 10）上。

在有线电视领域中，分开的解码器或有线机顶转换器盒包含适当的解码电路。有线电视发射机连接在远程摄象机 104（图 1-3）、输出接口 235（图 9B）、因特网主机 272、274、276、278、280（图 10）、通信介质 120、125（图 8B）或甚至用户终端 302、304、306、308、310（图 10）上。

通过引用结合在此的 1996 年 9 月 24 日颁给 Hendricks 等人美国

专利 5,559,549 公开了使用操作中心 1000、网络控制器 1020、连接的电缆系统（未编号）及机顶终端 1030 的有线电视系统。有线电视系统最好是数字的并可容易地与本发明交互作用。

图 21 示出本发明的实施例 900 与诸如 Hendricks 等人的'549 专利的通用系统 910 之间的交互作用。可将来自本发明的关于普通图象、存储的图象、广角图象、来自多台摄象机的图象、任何类型与交互式展示的信息的数字信号提供给 Hendricks 等人的'549 专利 910 的各种元件。应理解也可将这些数字信号提供给在输入端上接收数字信号（即，独立或使用数模转换器）的传统模拟和数字有线电视系统的对应元件。

具体地，可将来自远程摄象机 104 的数字图象 920 与远程广角图象 930、来自计算机 184 的处理过/压缩的数字图象 940、来自通信网 120 的图象 950、来自网站 140 的流送图象 960、来自通信网 125 的图象 970 及来自用户终端（即 302）的图象 980 传递给 Hendricks 等人的专利'549 的数字有线电视系统。这些图象信号可由操作中心 1000、卫星 1010、电缆头端 1020、或 Hendricks 等人的专利'549 的机顶终端 1030 接收。

类似地，操作中心 1000、卫星 1010、电缆头端 1020 与机顶终端 1030 可传递数字信号给本发明的因特网结构。具体地，这些传递的信号可由远程计算机 184、数据通信网 120（包含网站 130）、数据通信网 125 与用户终端（即 302）接收。

通过引用结合在此的 Hendricks 等人的美国专利 5,600,573 公开了带有文件服务器的操作中心。这一操作中心可替代图 21 中所示的操作中心 1000。

通过引用结合在此的名为“用于有线电视系统头端的网络管理器”的 1994 年 12 月 2 日提交的美国未决专利申请序号 08/352,205 公开了用于电缆头端的网络管理器。这一网络管理器可包含在图 21 中所示的电缆头端 1020 中。

因此，本发明能与能数字地发射与接收的有线电视系统全面集成。本发明冲破了电视网与计算机网之间的障碍允许成为单一的综合节目系统。

本领域的普通技术人员应理解，这里通过引用所结合的专利申请、专利及申请的其它方面可应用于本发明。因此，将这些专利申请、专利及申请全文结合在此。这里使用的名词与描述只是以示例方式提出的而并不意味着作为限制。熟悉本技术的人员会理解在下面的权利要求中所定义发明精神与范围内，许多变型是可能的。

说 明 书 附 图

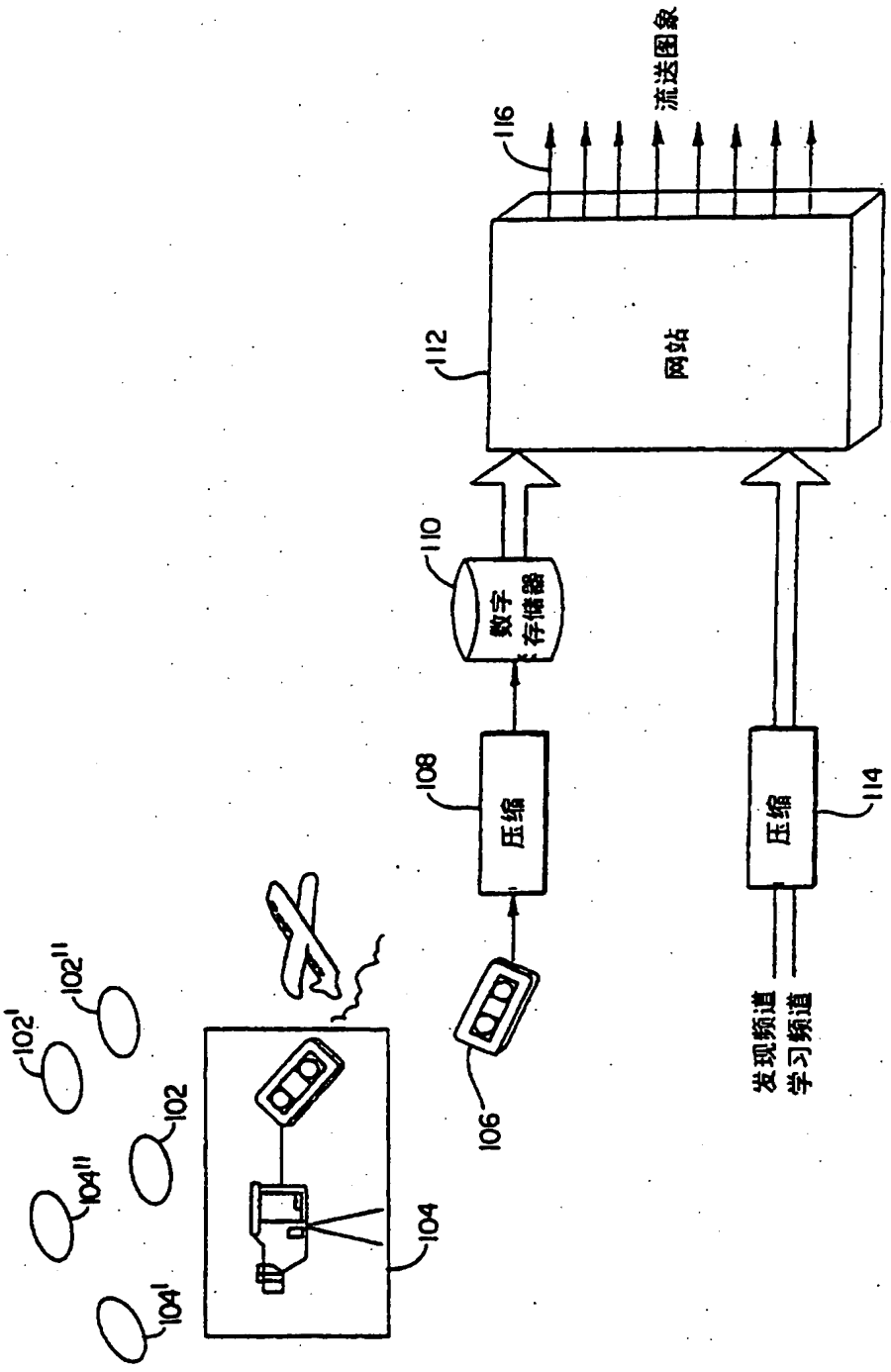

流送图象
116
网站
112
数字存储器
110
压缩
108
压缩
114
106
发现频道
学习频道
102'
102''
102
104''
104'
104

图 1

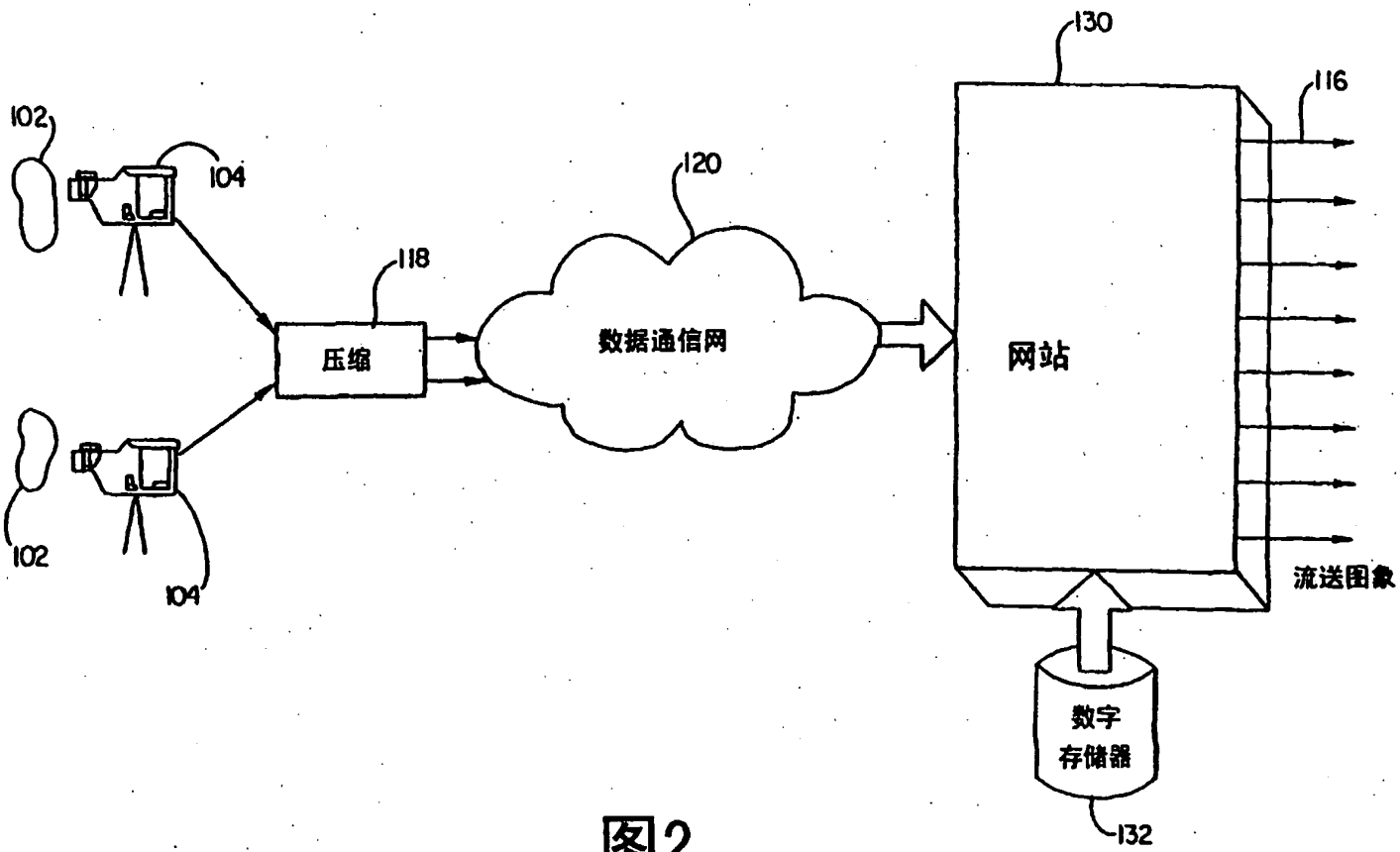


图2

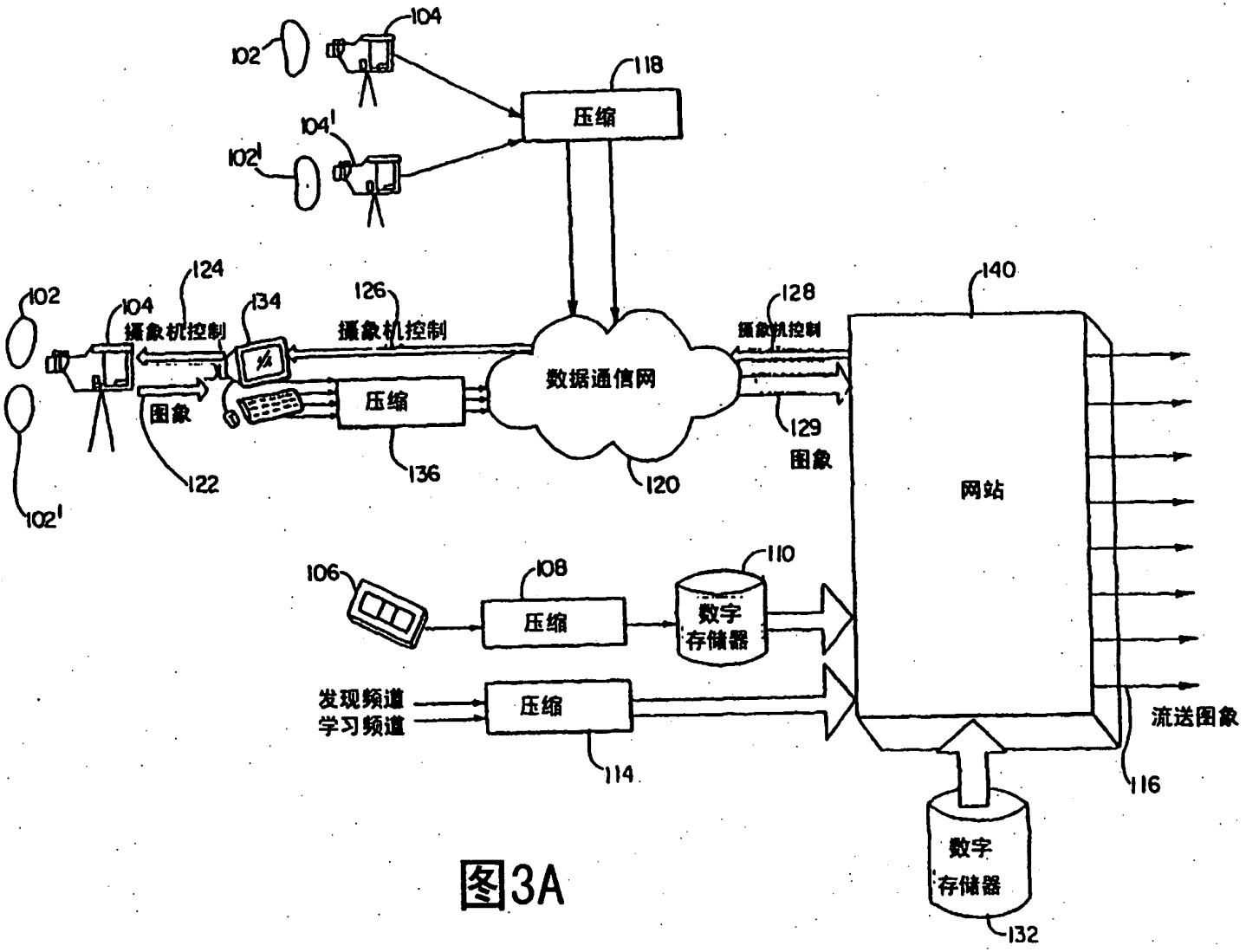

102
104
118
压缩
104'
102'
124
126
128
140
102
104
摄象机控制
134
摄象机控制
摄象机控制
图象
压缩
数据通信网
网站
129
图象
122
136
120
102'
106
108
110
压缩
数字
存储器
发现频道
学习频道
压缩
流送图象
114
116
数字
存储器
132

图3A

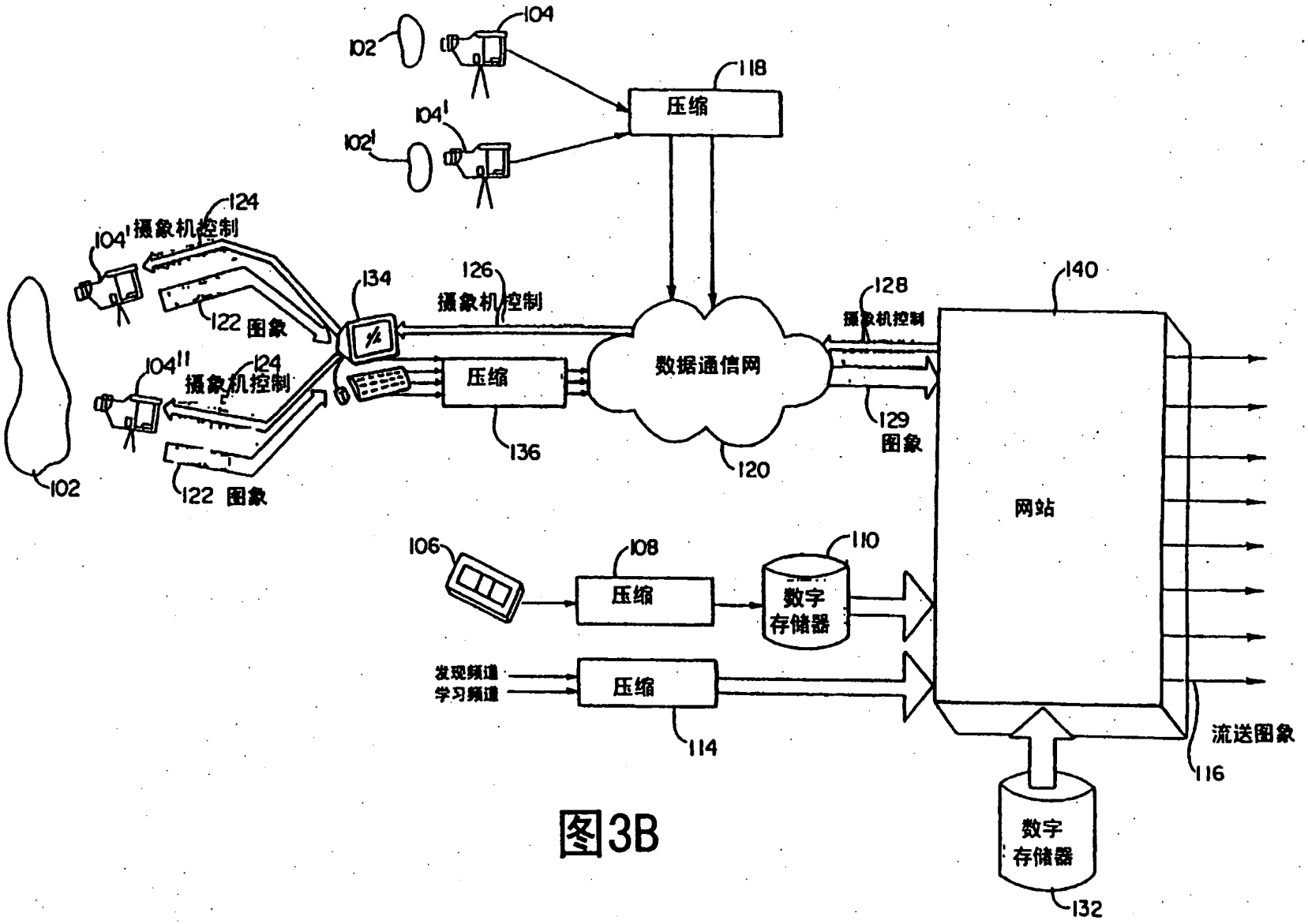

102
104
118
压缩
104'
102'
124
104' 摄象机控制
122 图象
134
126
摄象机控制
128
摄象机控制
140
104''
124
摄象机控制
压缩
数据通信网
129
图象
136
120
102
122 图象
网站
106
108
110
压缩
数字
存储器
发现频道
学习频道
压缩
流送图象
114
116
数字
存储器
132

图3B

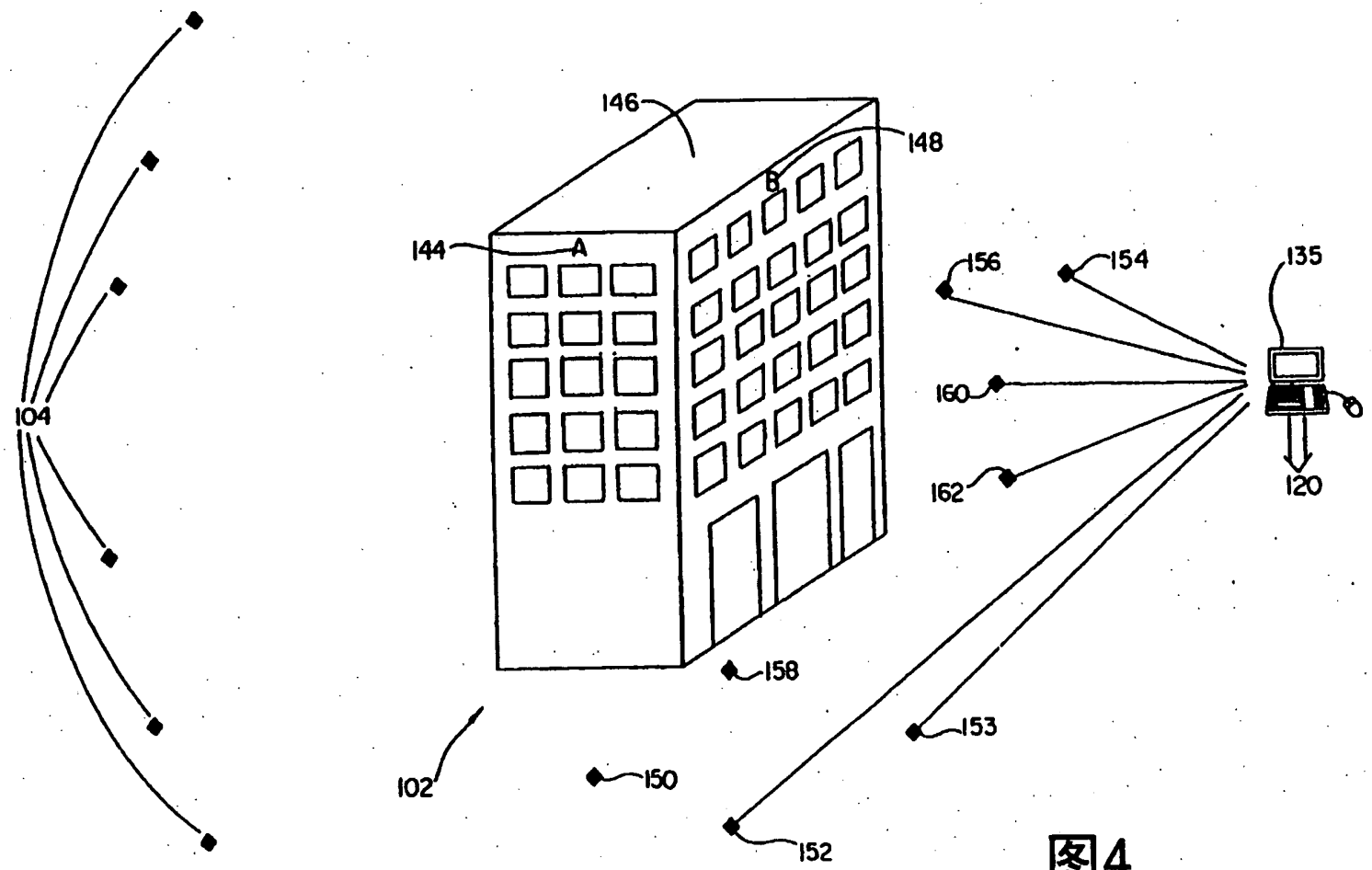


图4

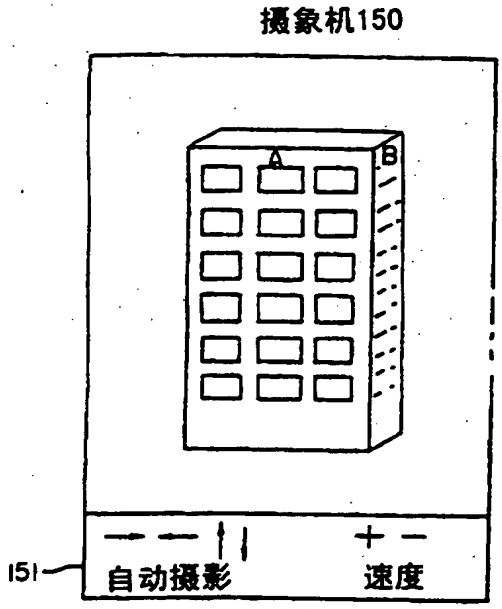


图5A

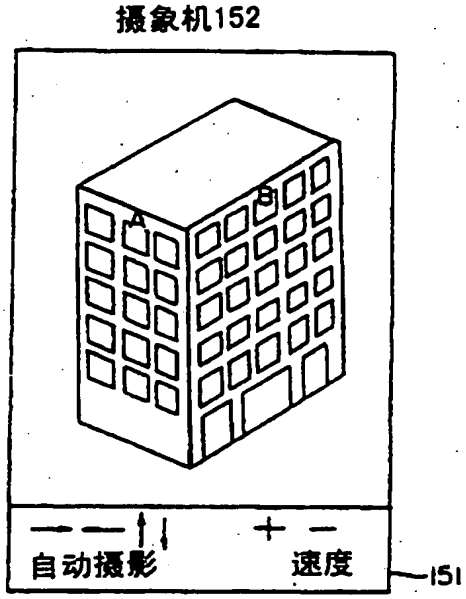


图5B

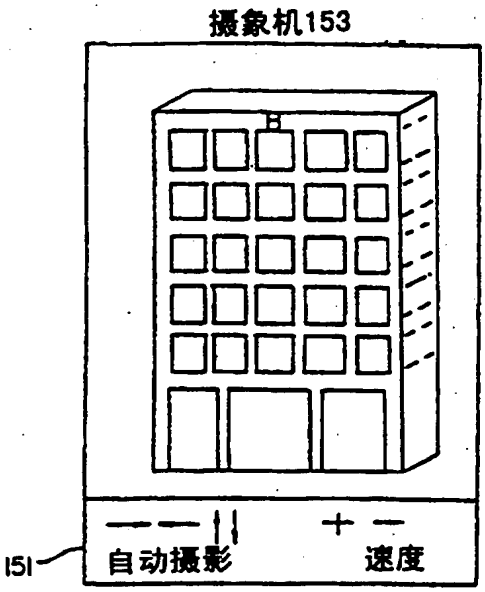


图5C

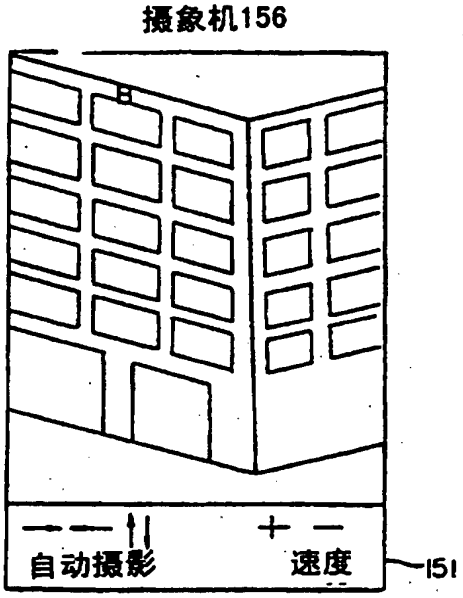


图5D

00-04-27

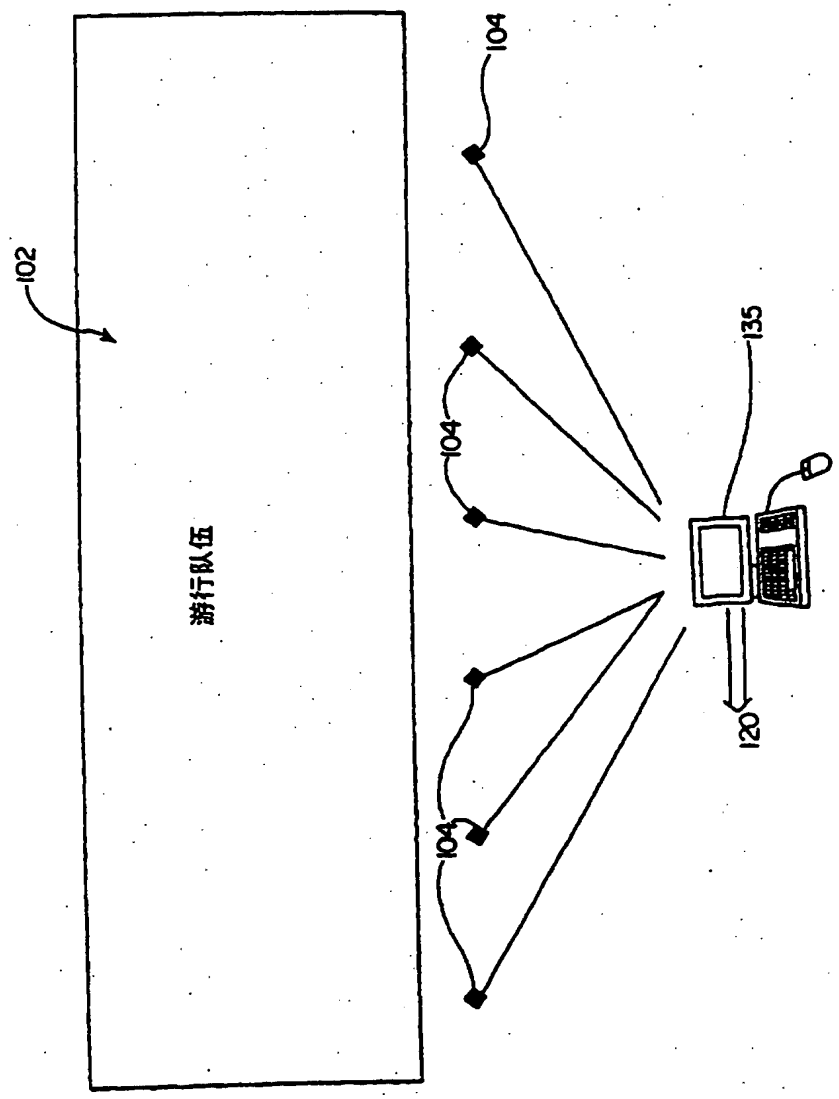


图6

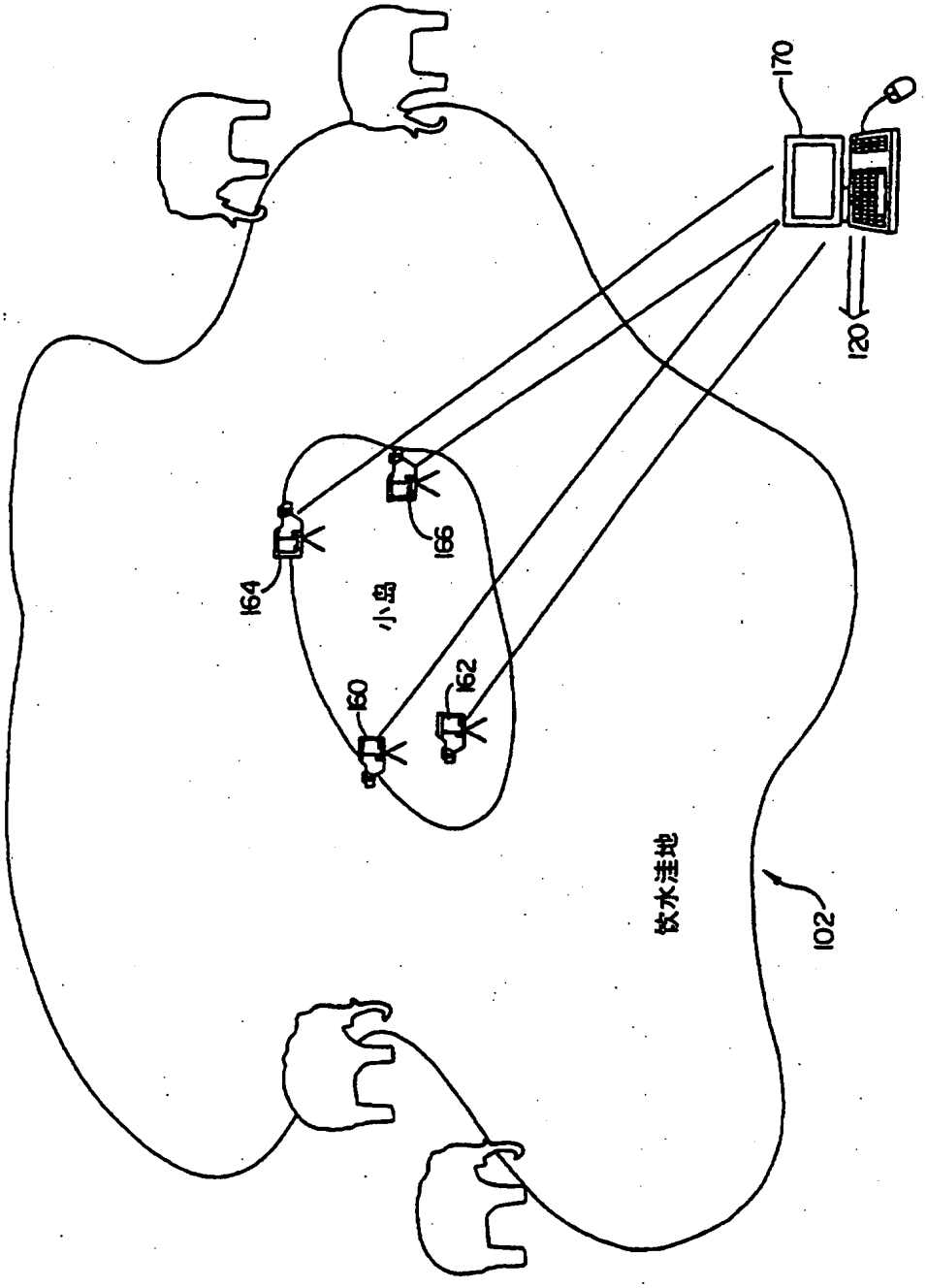


图7A

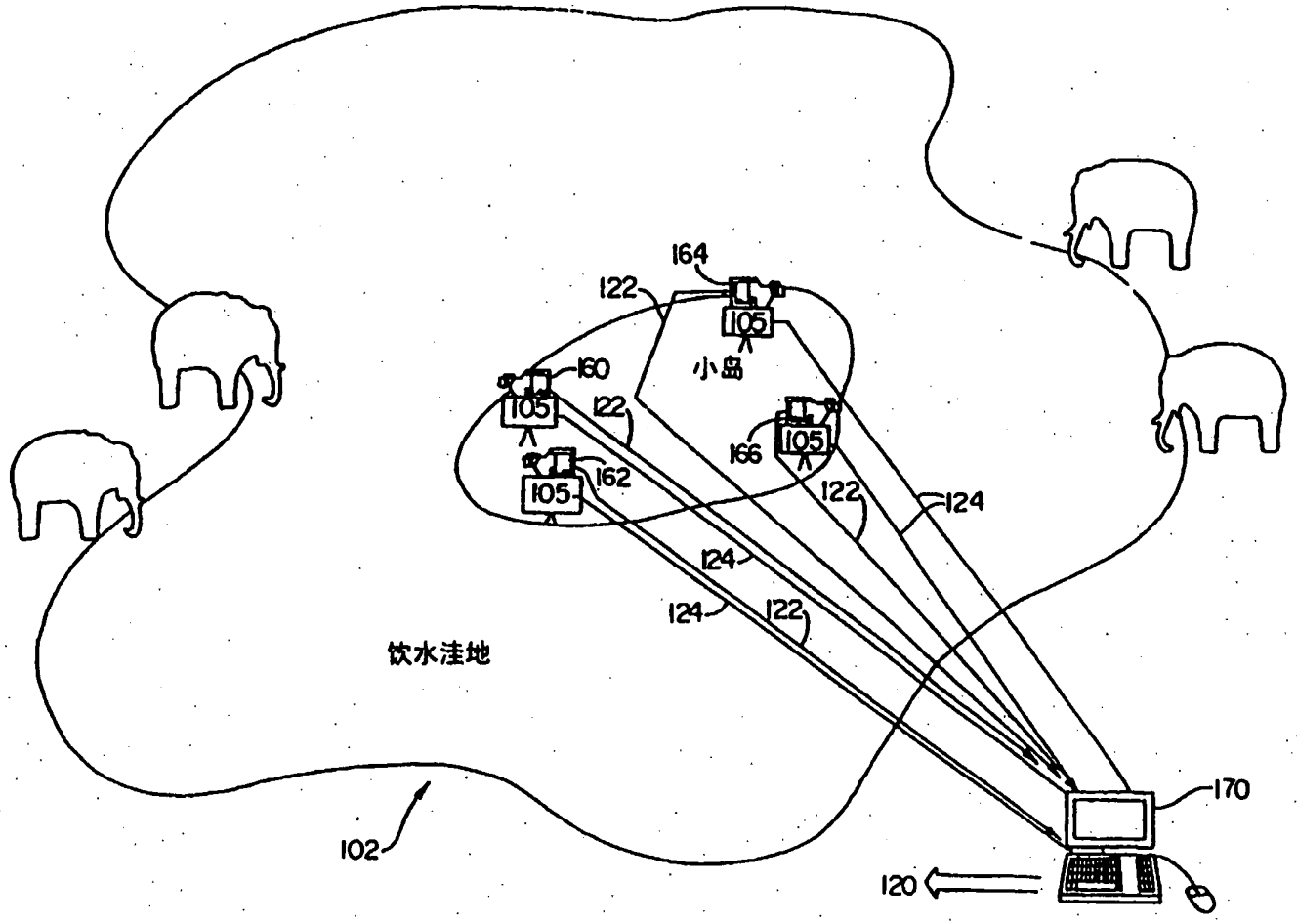

164
122
105
小岛
160
105
122
166
105
105
162
122
124
124
124
122
饮水洼地
102
170
120

图7B

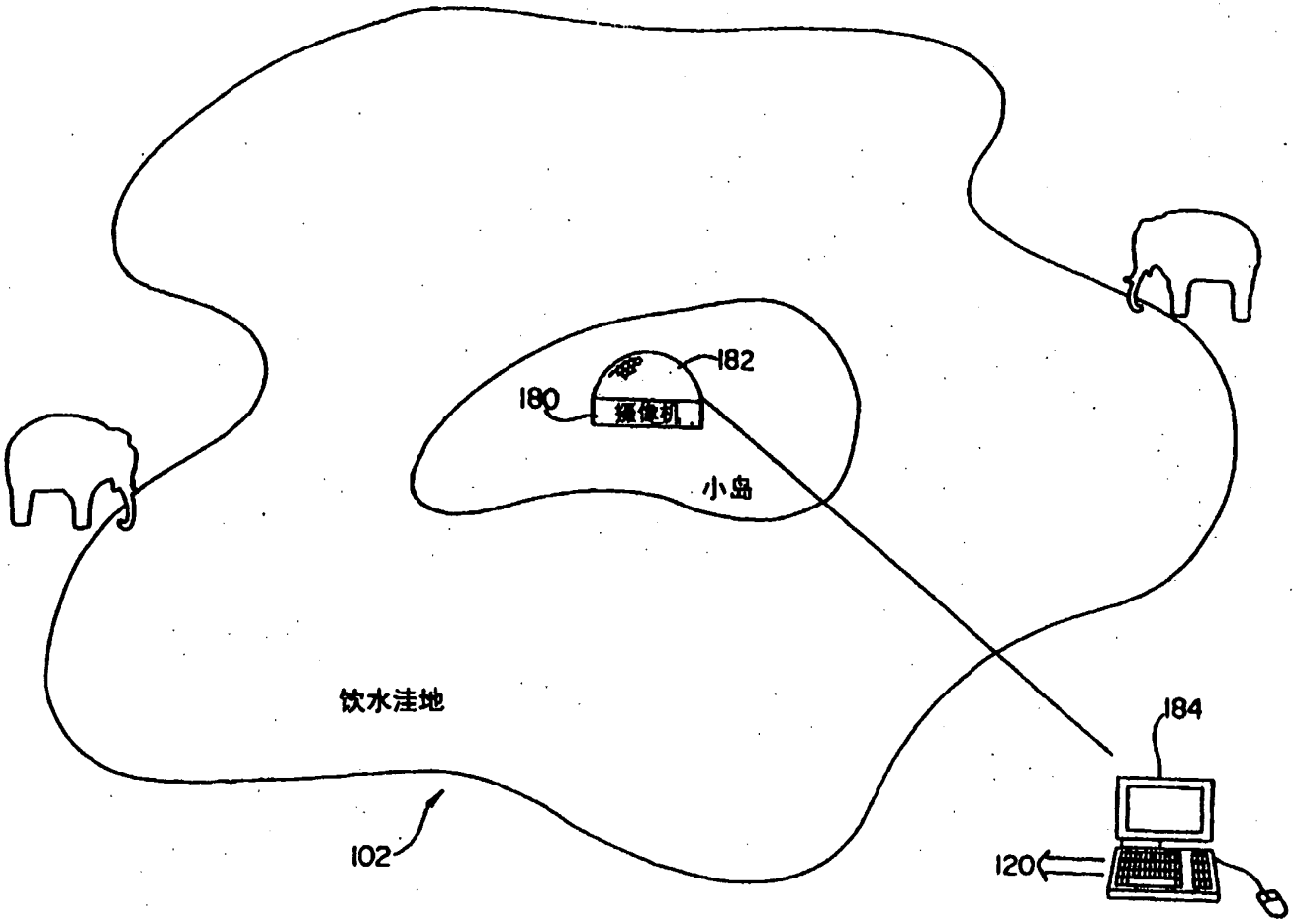


图8A

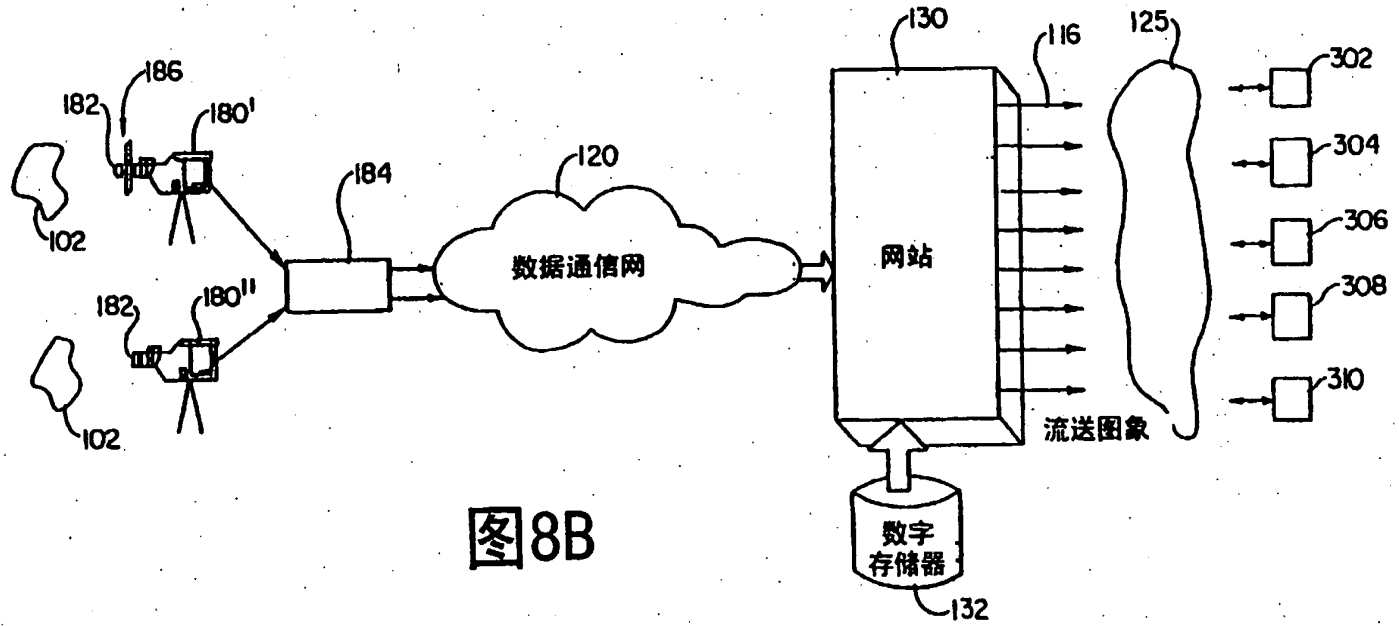

130
116
125
302
304
306
308
310
186
182
180'
184
120
102
数据通信网
网站
流送图象
182
180''
102
数字
存储器
132

图8B

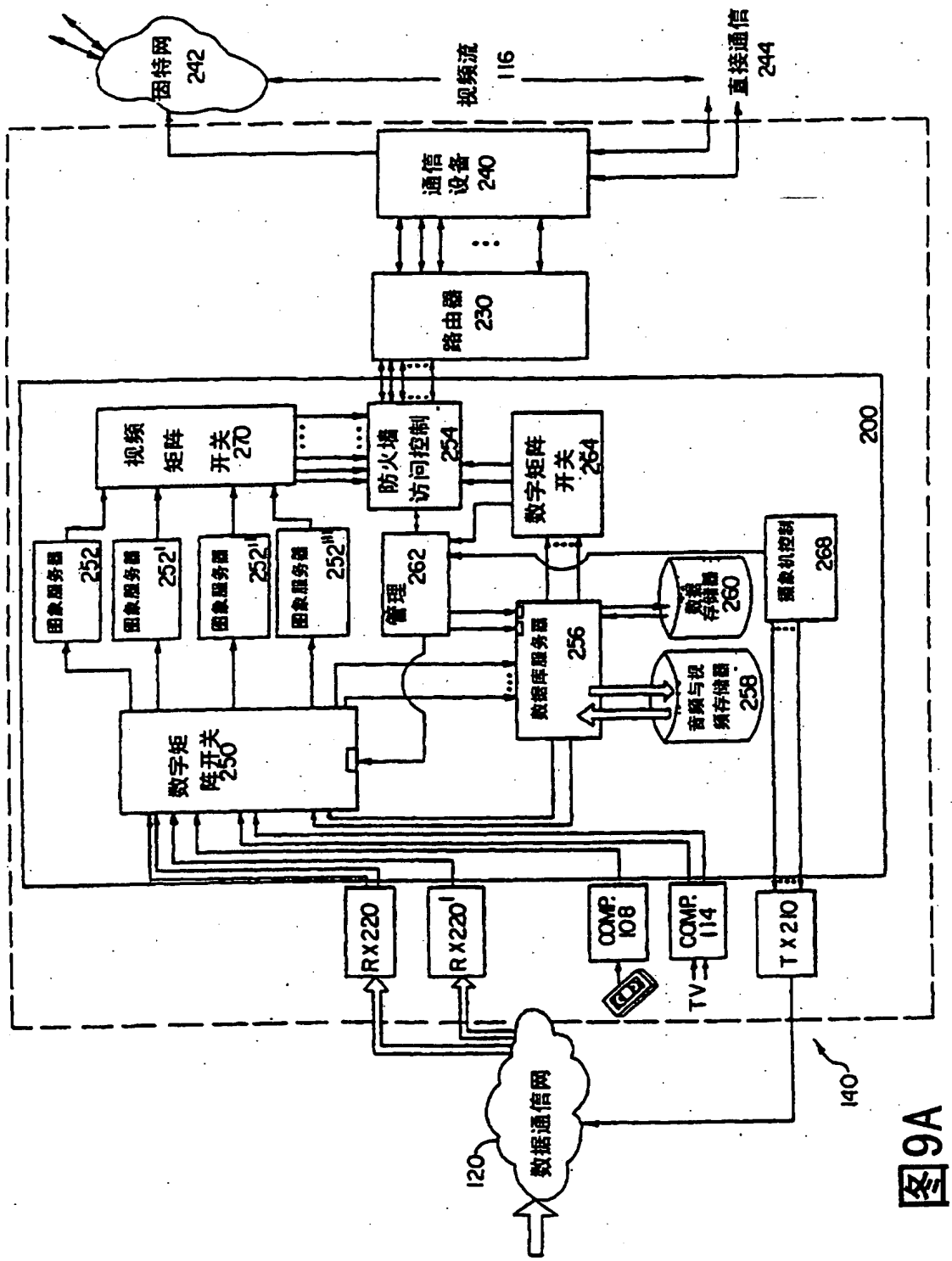

因特网
242
视频流
116
直接通信
244
通信设备
240
路由器
230
200
视频矩阵开关
270
防火墙访问控制
254
数字矩阵开关
264
图象服务器
252
252'
252''
252'''
管理
262
数据存储器
260
图象机控制
268
数据库服务器
256
音频与视频存储器
258
数字矩阵开关
250
RX 220
RX 220'
COMP. 108
COMP. 114
TV
TX 210
数据通信网
120
140

图9A

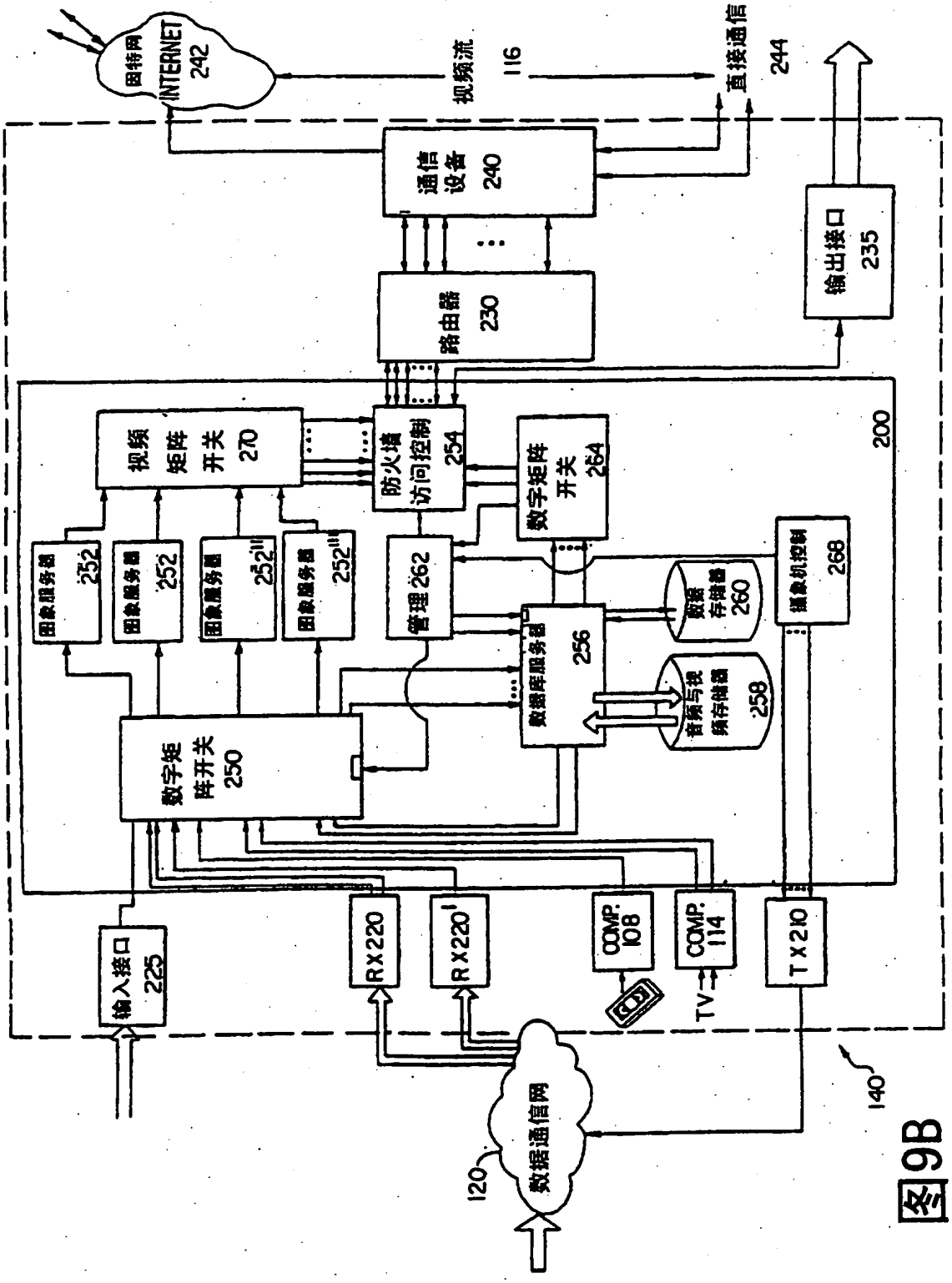

因特网
INTERNET
242
视频流
116
直接通信
244
通信设备
240
输出接口
235
路由器
230
200
视频矩阵开关
270
防火墙访问控制
254
数字矩阵开关
264
图象服务器
252
252'
252''
252'''
管理
262
数据存储器
260
图象机控制
268
数据库服务器
256
音频与视频存储器
258
数字矩阵开关
250
输入接口
225
RX 220
RX 220'
COMP.
108
COMP.
114
TV
TX 210
数据通信网
120
140

图9B

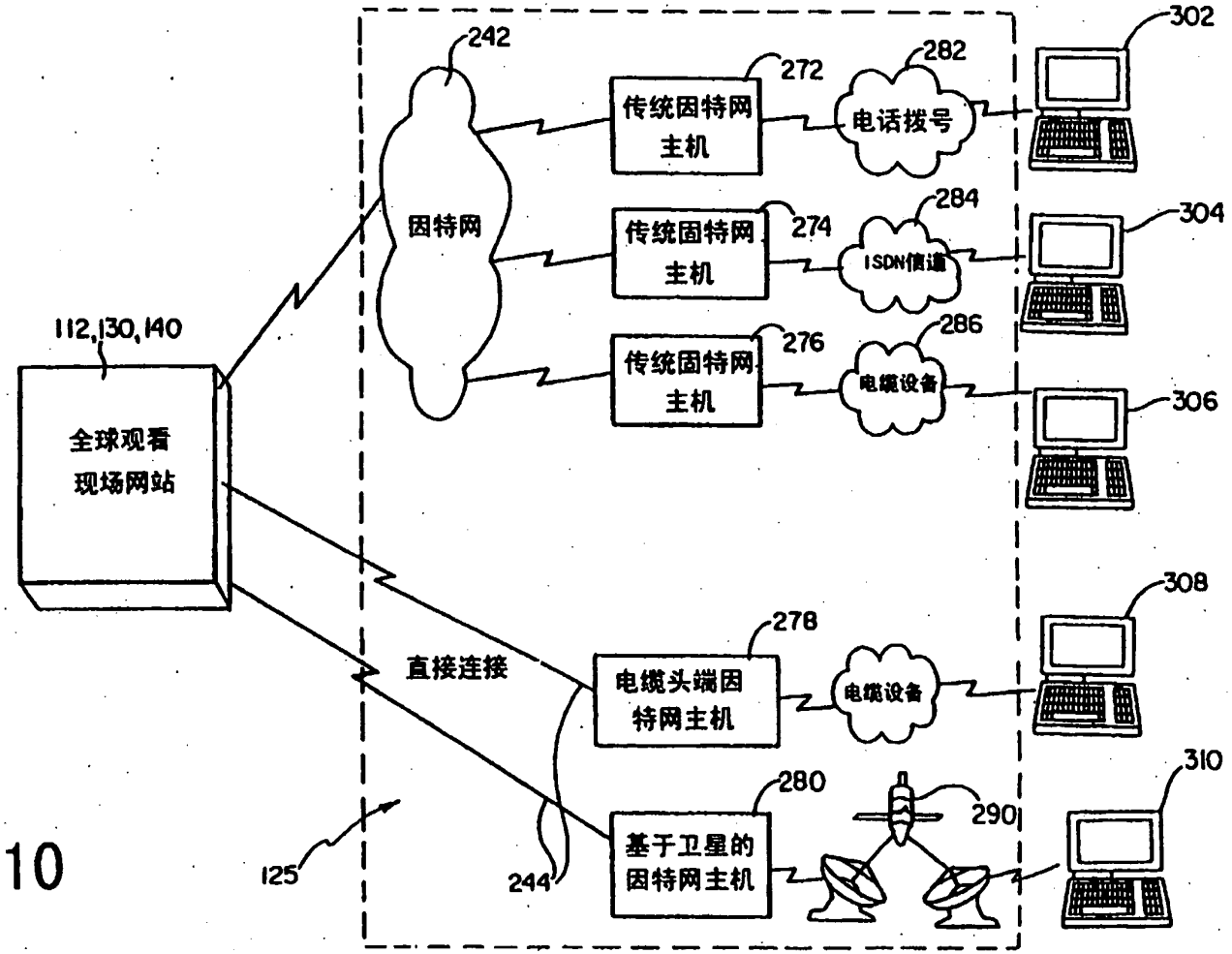
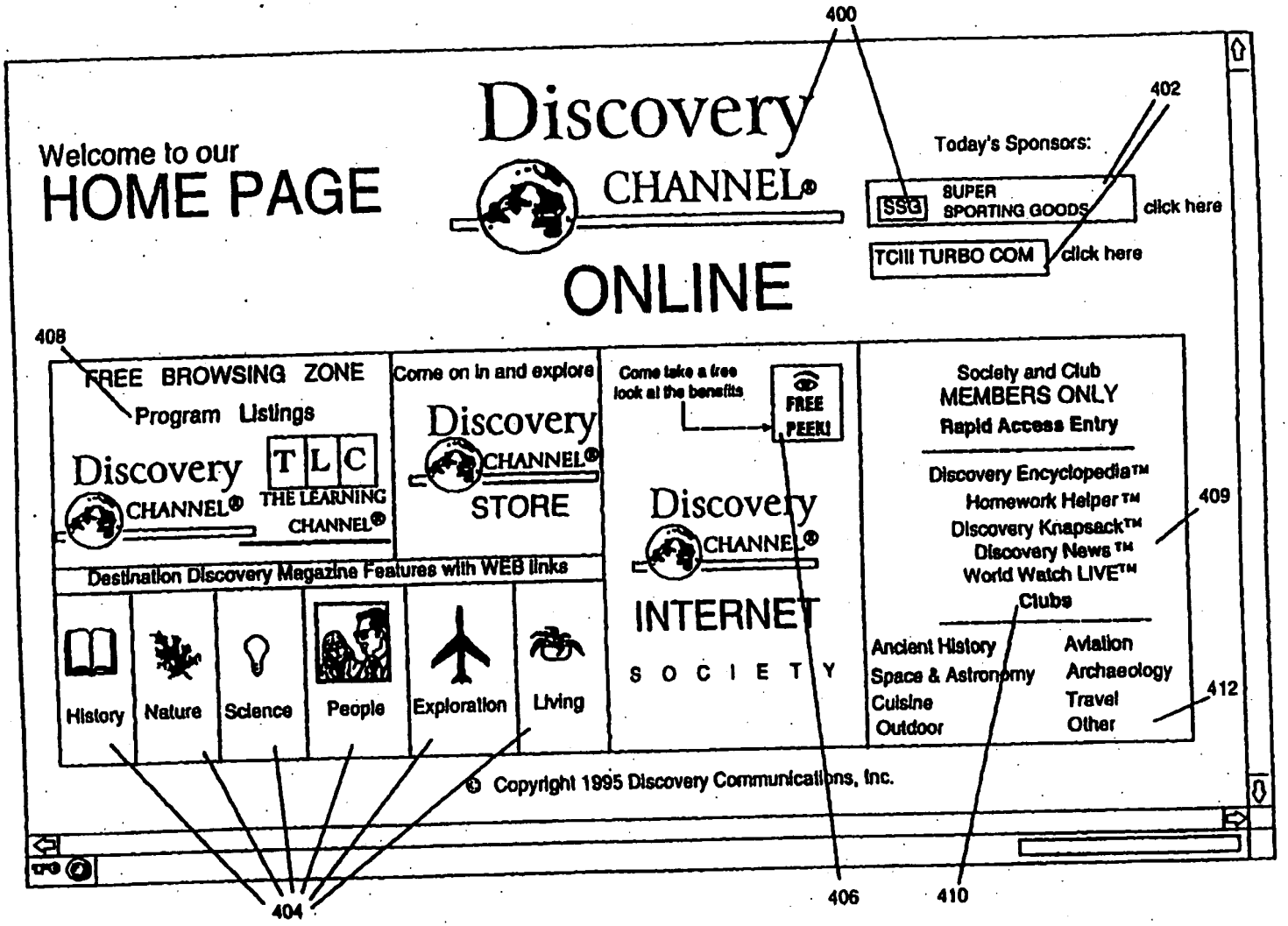

242
因特网
272
传统因特网主机
282
电话拨号
302
284
274
传统固特网主机
ISDN信道
304
112,130,140
全球观看现场网站
276
传统固特网主机
286
电缆设备
306
直接连接
278
电缆头端因特网主机
电缆设备
308
280
290
基于卫星的因特网主机
310
125
244

图10


400
Welcome to our
HOME PAGE
Discovery
CHANNEL®
ONLINE
402
Today's Sponsors:
SSG SUPER SPORTING GOODS
click here
TCIII TURBO COM
click here
408
FREE BROWSING ZONE
Program Listings
Discovery CHANNEL®
T L C THE LEARNING CHANNEL®
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Discovery CHANNEL® STORE
Come take a free look at the benefits
FREE PEEK!
Discovery CHANNEL®
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MEMBERS ONLY
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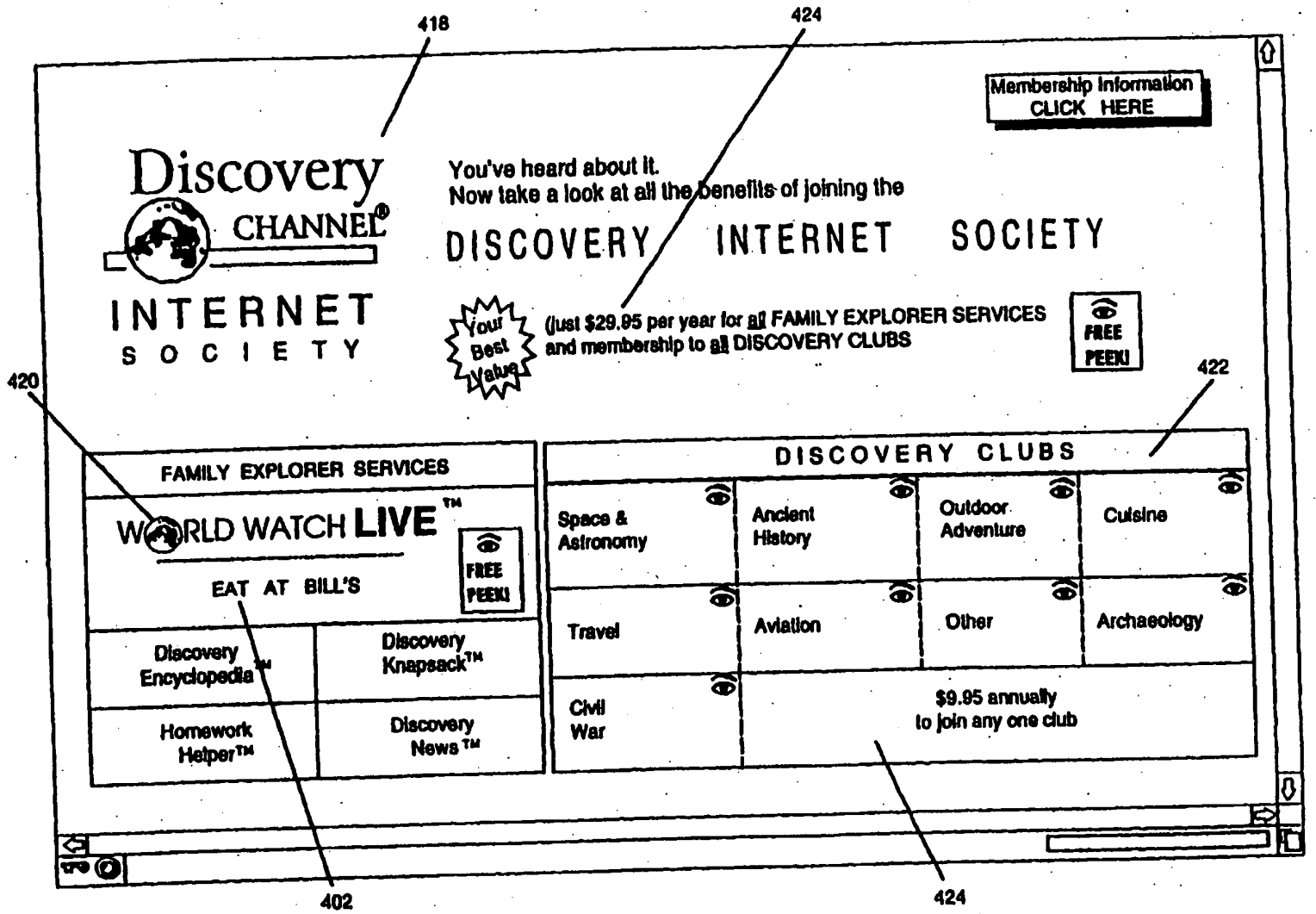
Discovery Encyclopedia™
Homework Helper™
Discovery Knapsack™
Discovery News™
World Watch LIVE™
409
Clubs
Ancient History
Space & Astronomy
Cuisine
Outdoor
Aviation
Archaeology
Travel
Other
412
Destination Discovery Magazine Features with WEB links
History
Nature
Science
People
Exploration
Living
© Copyright 1995 Discovery Communications, Inc.
404
406
410

図11


418
424
Membership Information
CLICK HERE
Discovery
CHANNEL
INTERNET
SOCIETY
You've heard about it.
Now take a look at all the benefits of joining the
DISCOVERY INTERNET SOCIETY
Your Best Value
(just $29.95 per year for all FAMILY EXPLORER SERVICES
and membership to all DISCOVERY CLUBS
FREE PEEK!
420
422
FAMILY EXPLORER SERVICES
WORLD WATCH LIVE™
EAT AT BILL'S
FREE PEEK!
Discovery Encyclopedia™
Discovery Knapsack™
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DISCOVERY CLUBS
Space & Astronomy
Ancient History
Outdoor Adventure
Cuisine
Travel
Aviation
Other
Archaeology
Civil War
$9.95 annually
to join any one club
402
424

图12

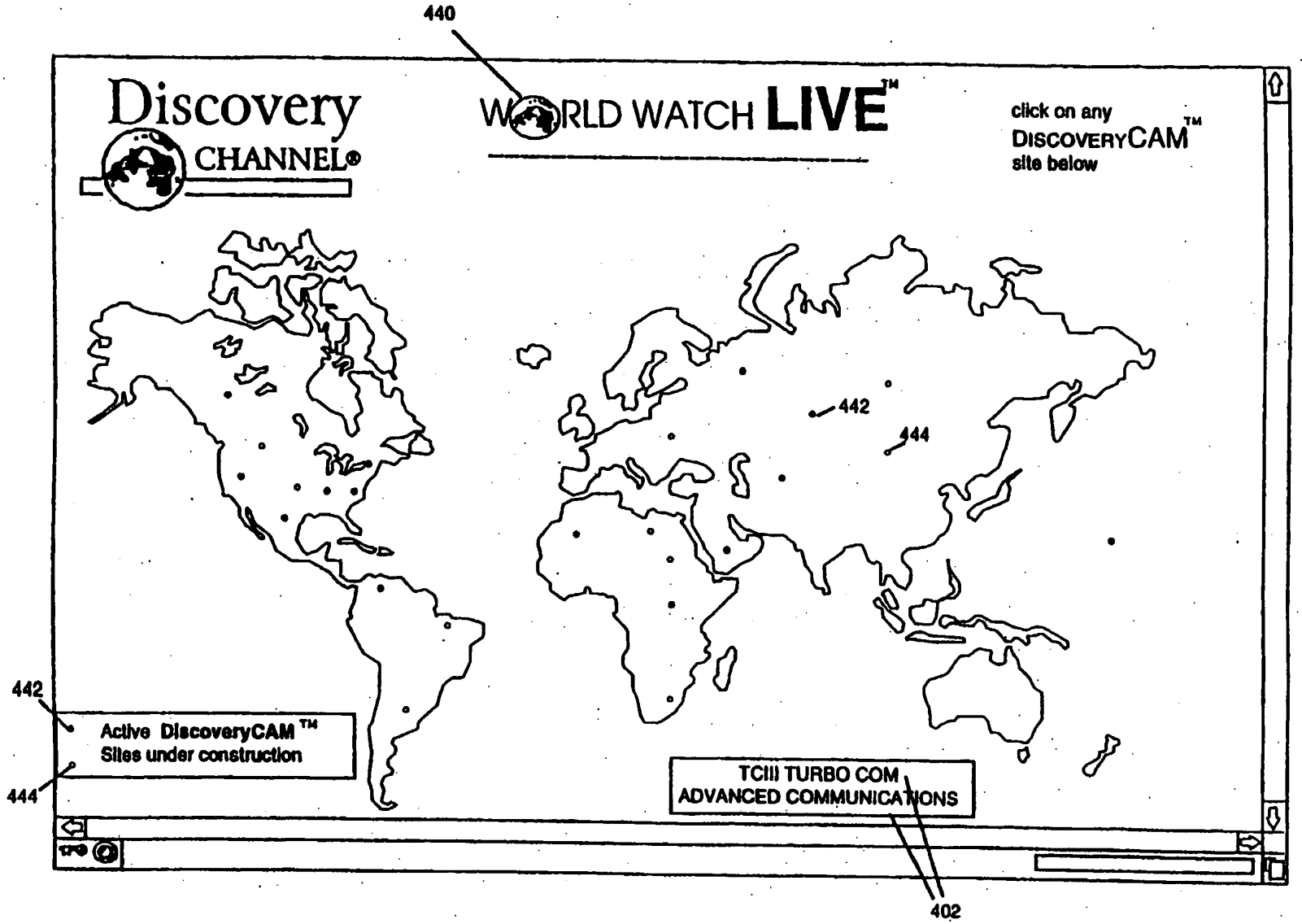

440
Discovery CHANNEL®
WORLD WATCH LIVE™
click on any DISCOVERYCAM™ site below
442
444
442
Active DiscoveryCAM™ Sites under construction
444
TCIII TURBO COM ADVANCED COMMUNICATIONS
402

图13

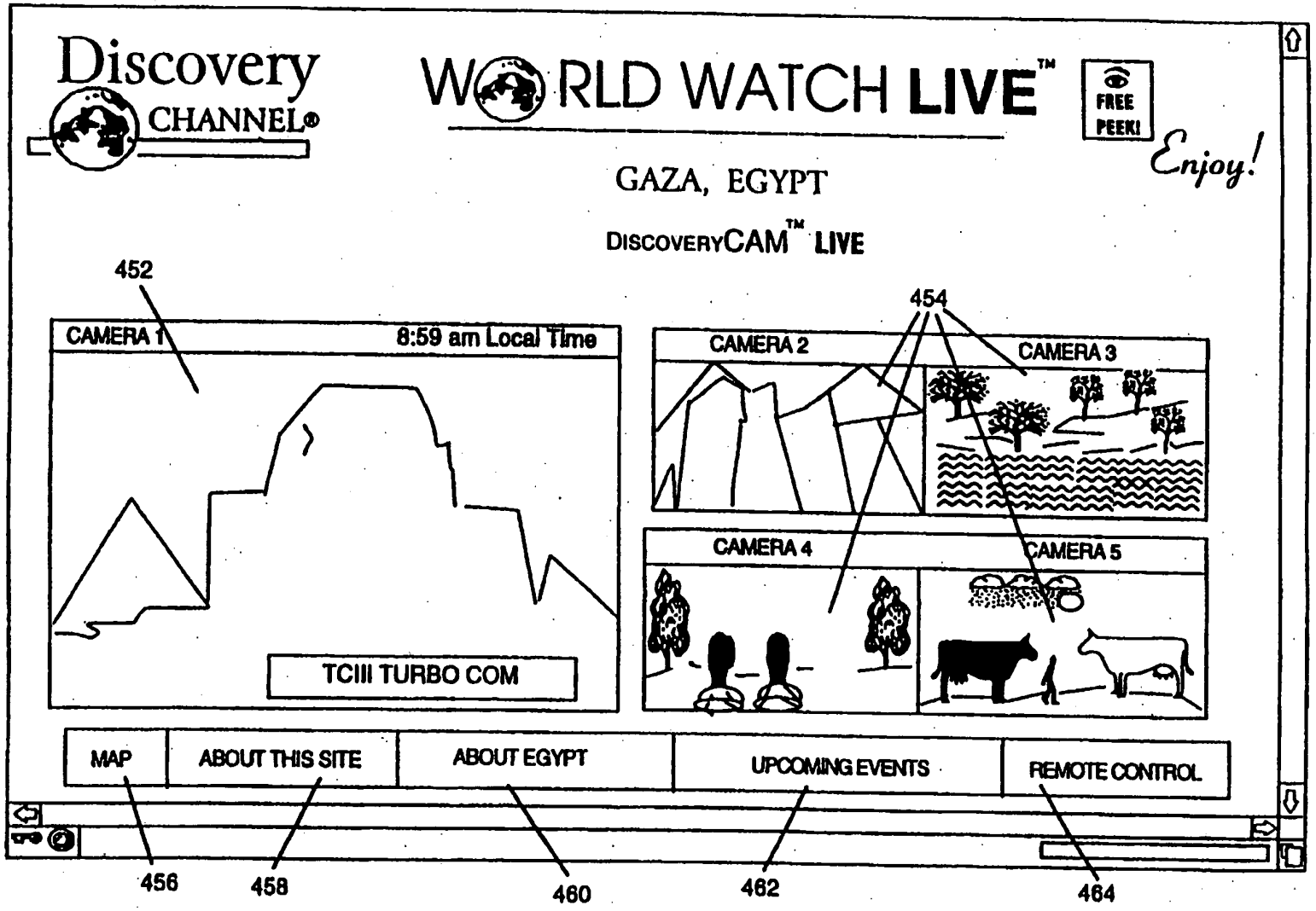

Discovery CHANNEL®
WORLD WATCH LIVE™
FREE PEEK!
Enjoy!
GAZA, EGYPT
DISCOVERYCAM™ LIVE
452
454
CAMERA 1
8:59 am Local Time
CAMERA 2
CAMERA 3
CAMERA 4
CAMERA 5
TCIII TURBO COM
MAP
ABOUT THIS SITE
ABOUT EGYPT
UPCOMING EVENTS
REMOTE CONTROL
456
458
460
462
464

図14

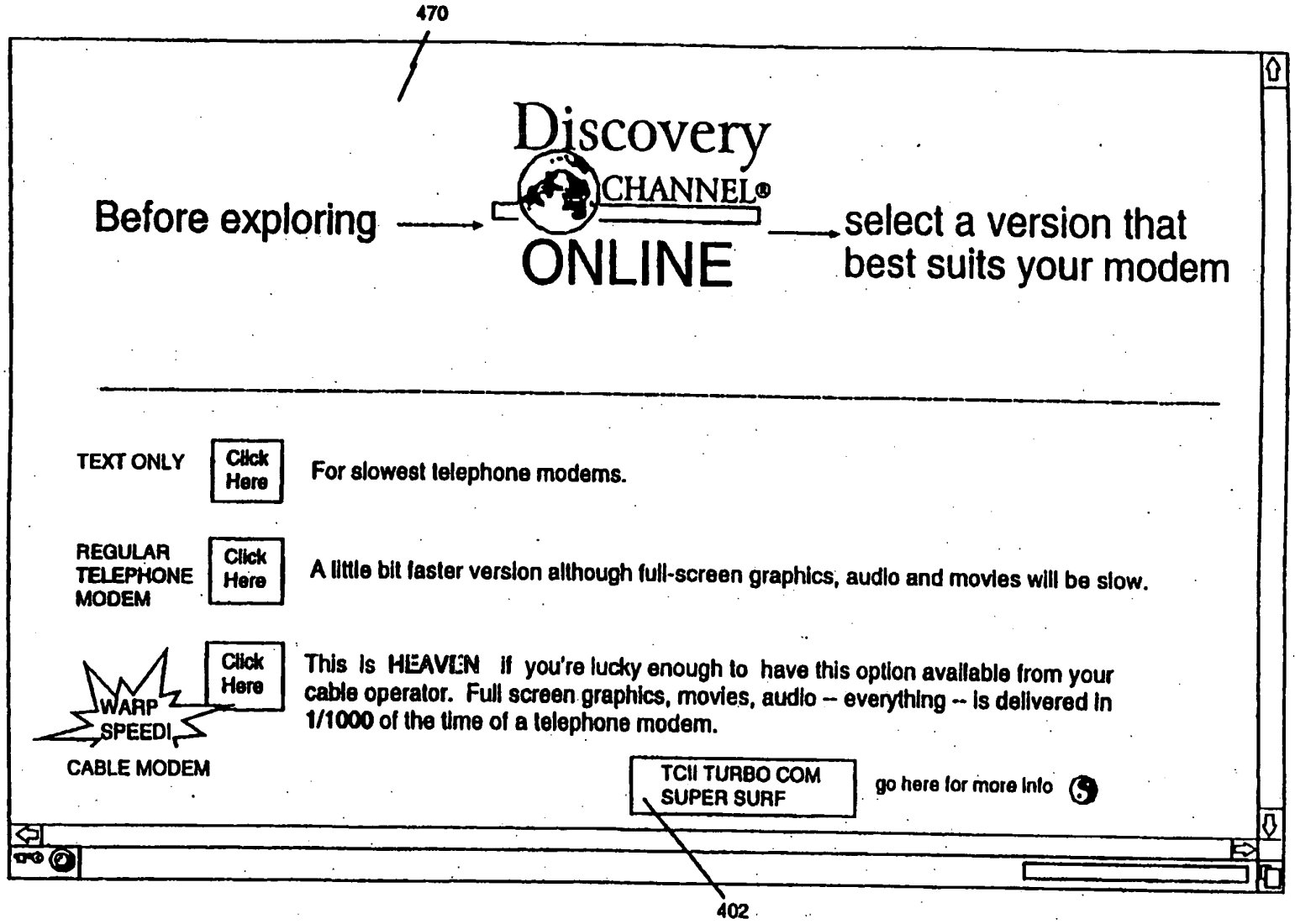

470
Discovery
CHANNEL®
ONLINE
Before exploring
select a version that best suits your modem
TEXT ONLY
Click Here
For slowest telephone modems.
REGULAR TELEPHONE MODEM
Click Here
A little bit faster version although full-screen graphics, audio and movies will be slow.
WARP SPEED!
Click Here
This is HEAVEN if you're lucky enough to have this option available from your cable operator. Full screen graphics, movies, audio -- everything -- is delivered in 1/1000 of the time of a telephone modem.
CABLE MODEM
TCII TURBO COM SUPER SURF
go here for more info
402

图15

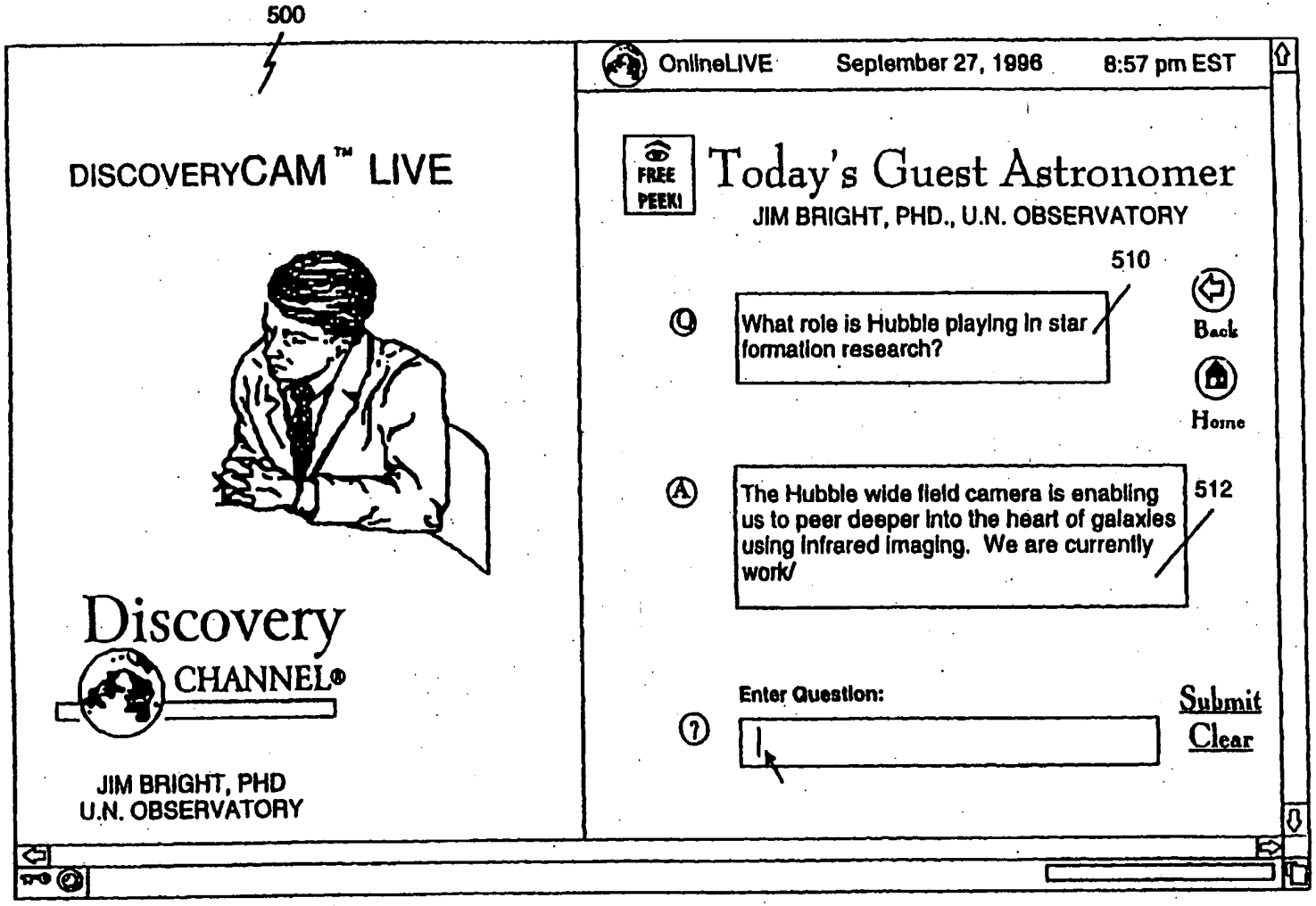
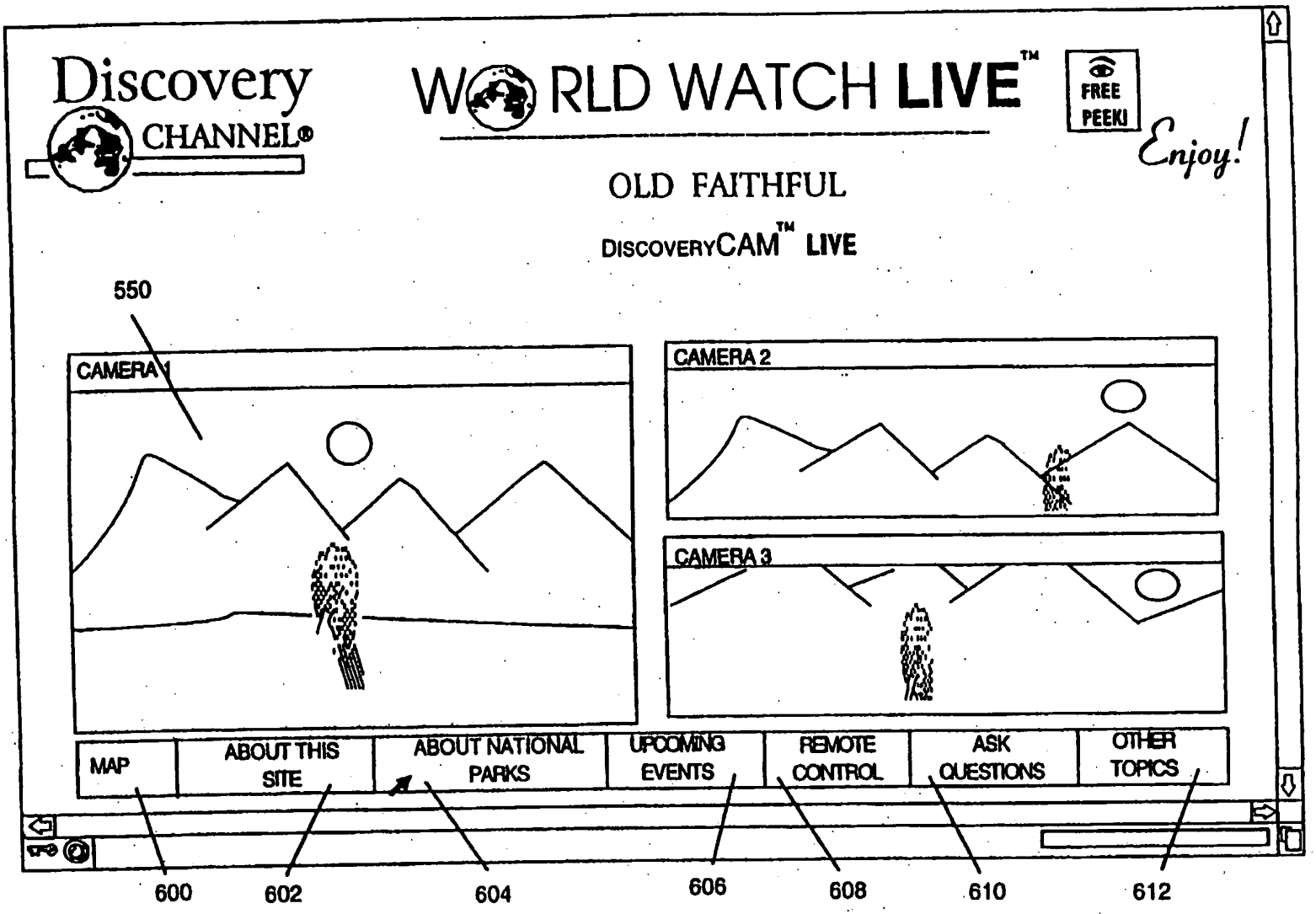

500
OnlineLIVE
September 27, 1996
8:57 pm EST
DISCOVERYCAM™ LIVE
Discovery
CHANNEL®
JIM BRIGHT, PHD
U.N. OBSERVATORY
FREE PEEK!
Today's Guest Astronomer
JIM BRIGHT, PHD., U.N. OBSERVATORY
510
Q
What role is Hubble playing in star formation research?
Back
Home
A
The Hubble wide field camera is enabling us to peer deeper into the heart of galaxies using infrared imaging. We are currently work/
512
Enter Question:
Submit
Clear

图16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WORLD WATCH LIVE™
FREE PEEK!
Enjoy!
OLD FAITHFUL
DISCOVERYCAM™ LIVE
550
CAMERA 1
CAMERA 2
CAMERA 3
MAP
ABOUT THIS SITE
ABOUT NATIONAL PARKS
UPCOMING EVENTS
REMOTE CONTROL
ASK QUESTIONS
OTHER TOPICS
600
602
604
606
608
610
612

图17

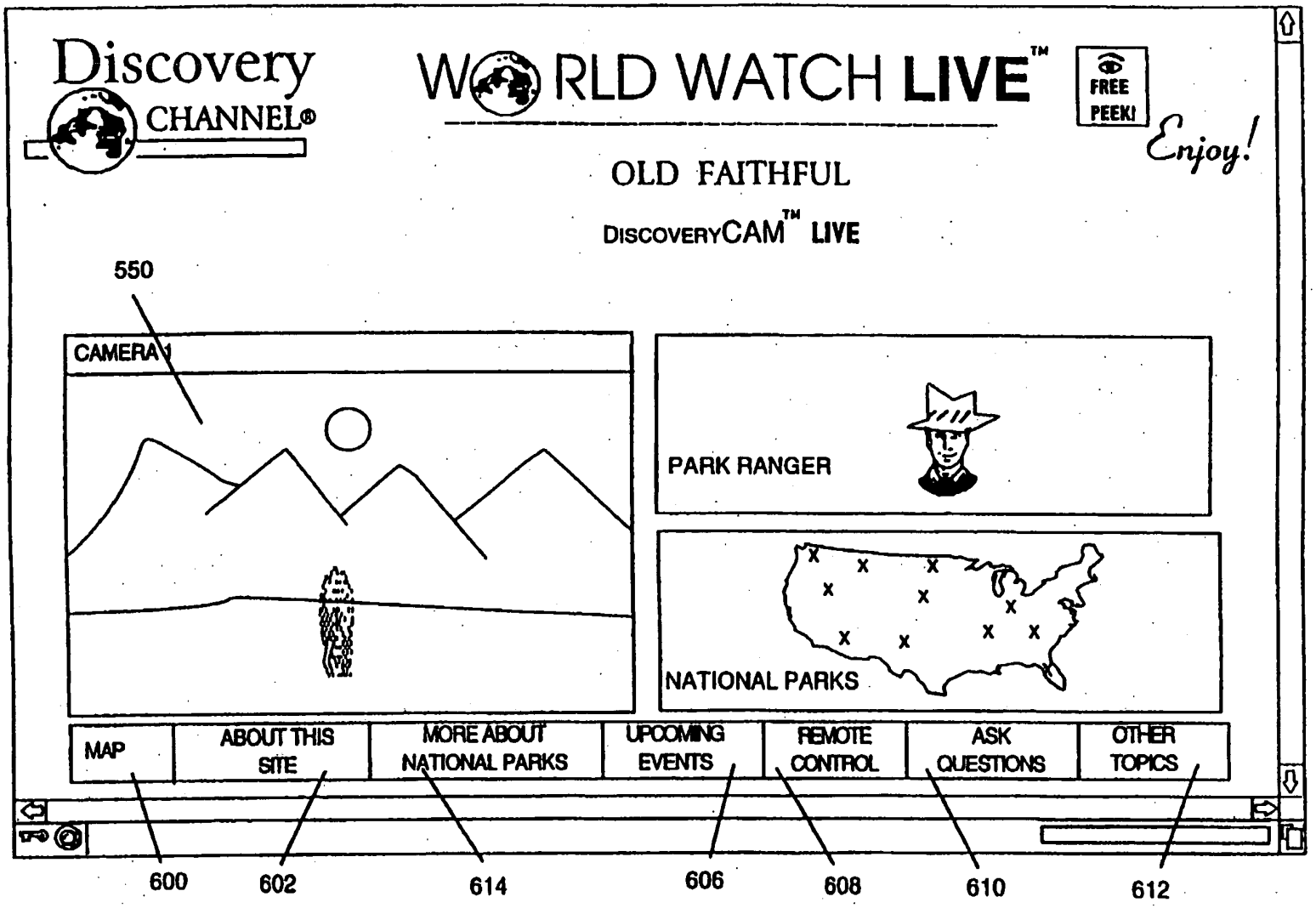
Discovery CHANNEL®
WORLD WATCH LIVE™
FREE PEEK!
Enjoy!
OLD FAITHFUL
DISCOVERYCAM™ LIVE
550
CAMERA 1
PARK RANGER
NATIONAL PARKS
MAP
ABOUT THIS SITE
MORE ABOUT NATIONAL PARKS
UPCOMING EVENTS
REMOTE CONTROL
ASK QUESTIONS
OTHER TOPICS
600
602
614
606
608
610
612

图18

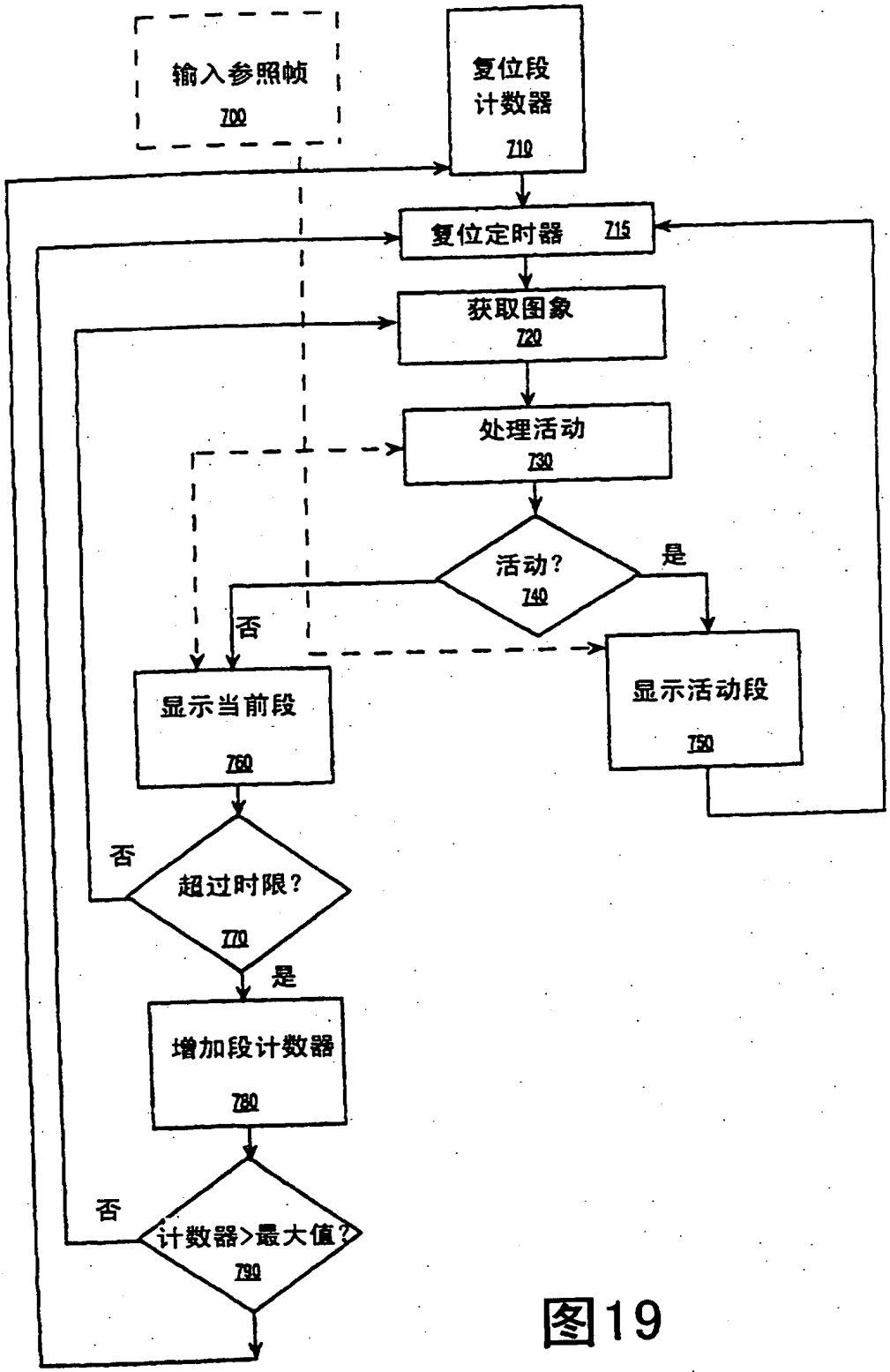
输入参照帧
700
复位段计数器
710
复位定时器 715
获取图象
720
处理活动
730
活动?
740
是
否
显示活动段
750
显示当前段
760
超过时限?
770
否
是
增加段计数器
780
计数器>最大值?
790
否

图19

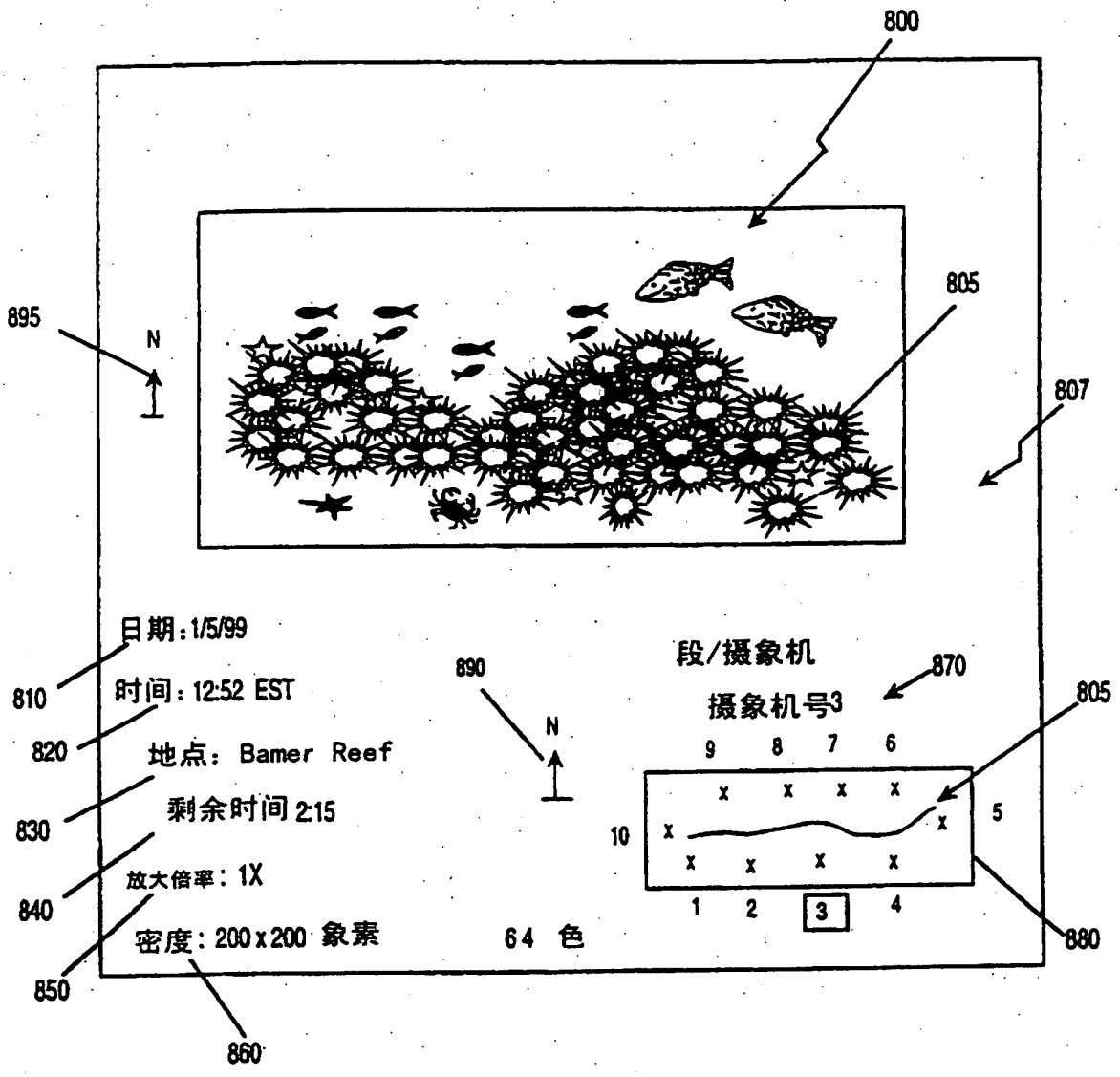
800
805
807
895
N
日期：1/5/99
810
时间：12:52 EST
820
地点：Bamer Reef
830
剩余时间 2:15
840
放大倍率：1X
850
密度：200 x 200 象素
860
64 色
890
N
段/摄象机
870
摄象机号3
805
9 8 7 6
10
5
1 2 3 4
880

图20

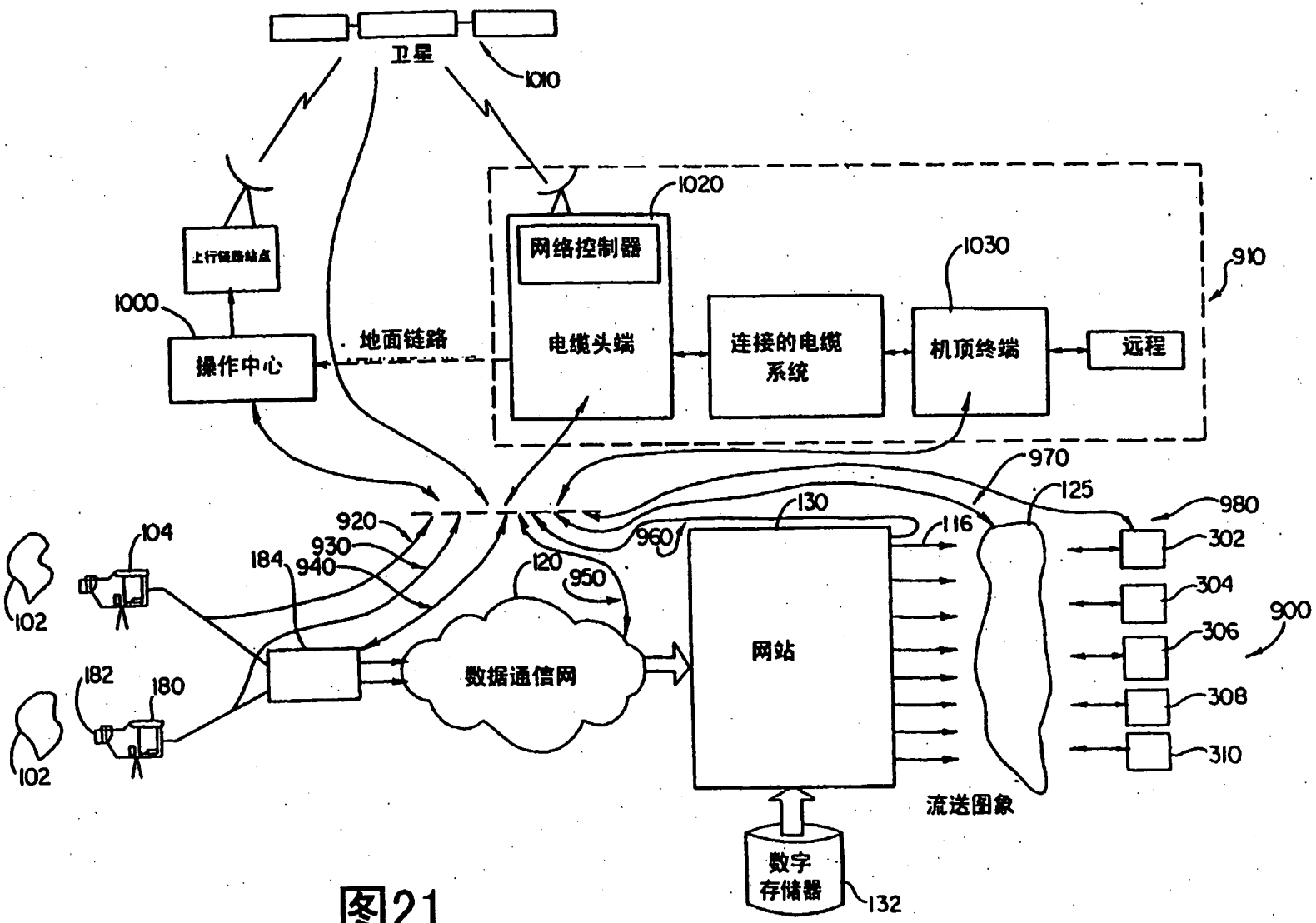
卫星
1010
上行链路站点
1000
操作中心
地面链路
1020
网络控制器
电缆头端
1030
连接的电缆系统
机顶终端
远程
910
970
125
980
130
960
116
302
304
306
308
310
900
920
930
940
184
104
102
182
180
120
950
数据通信网
网站
流送图象
数字存储器
132

图21